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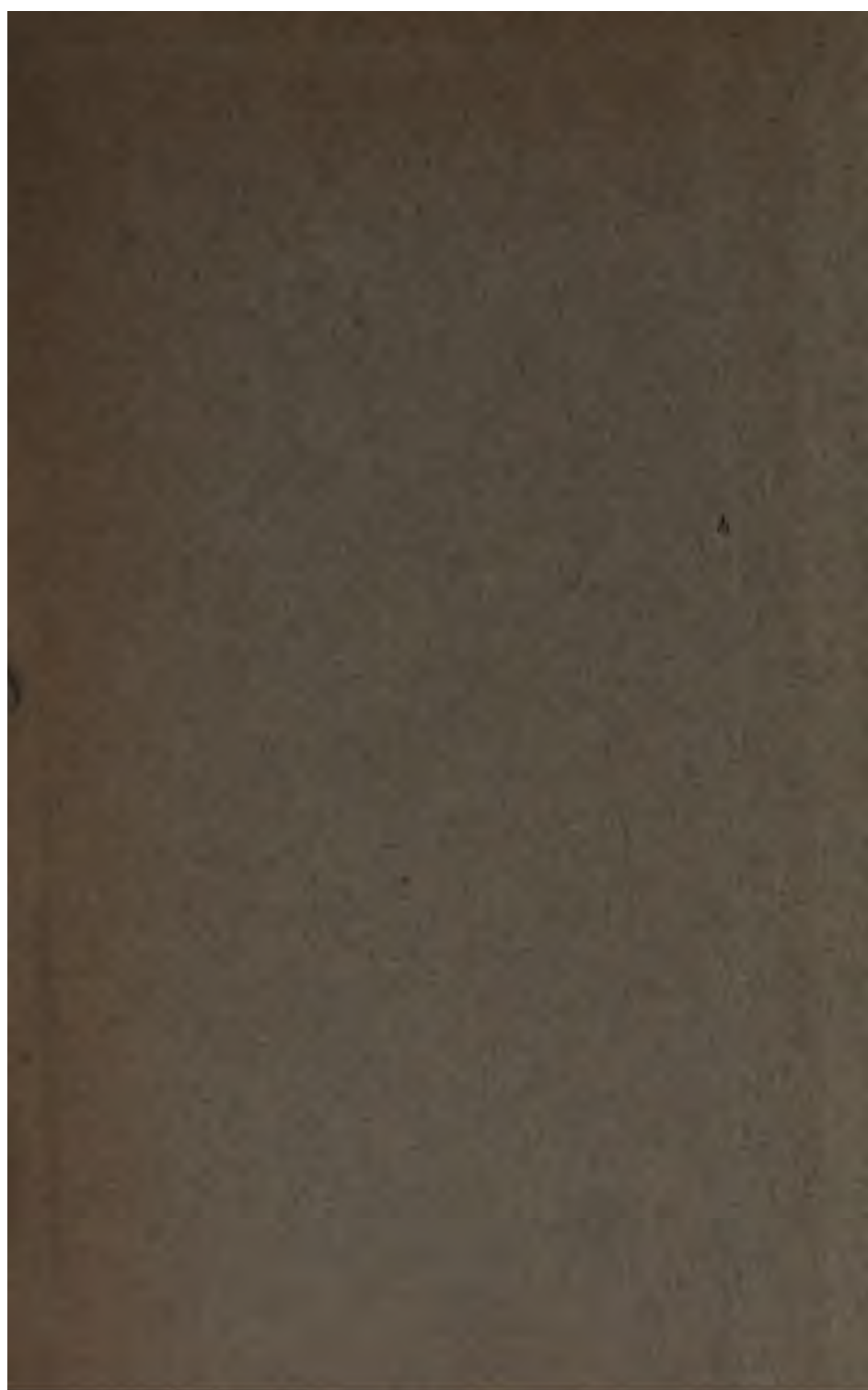
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Massachusetts

V.D.A.

PUBLIC DOCUMENT

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ANNUAL REPORT

OF THE

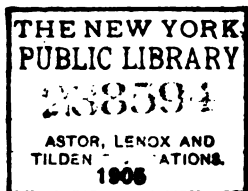


BOARD OF HARBOR AND LAND COMMISSIONERS

FOR THE YEAR 1900.

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WILLIAM
CLINTON
HARRIS

Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1900, covering a period of twelve months, from Nov. 30, 1899.

From Dec. 1, 1899, to Nov. 30, 1900, the Board has held 234 meetings, has given 296 formal and informal hearings, and has received 159 petitions for license to build and maintain structures and for privileges in tide waters, great ponds and the Connecticut River, to dredge material, to remove material from beaches, and for other purposes.

One hundred and seventeen licenses for structures and privileges in tide waters, great ponds and the Connecticut River have been granted during the year; also 27 permits for dredging, for the removal of material from beaches, and for other purposes.

One hundred and five inspections have been made by the Board at various times of work completed and in progress, under appropriations made by the Legislature, in Boston harbor, on the Commonwealth flats at South Boston, the Province Lands in Provincetown, Connecticut River at Hadley, at Green Harbor, Osterville, Lewis Bay, Lake Anthony, Menamsha Inlet, Witchmere harbor, Scituate beach and Scorton harbor; also of the Commonwealth flats at East Boston, the New Bedford and Fairhaven bridge, North

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River, Pleasant Bay in Chatham, Waquoit Bay and Cuttyhunk harbor; also of the sites of proposed work in tide water, great ponds and Connecticut River, upon petitions and plans presented to the Board; and also of various beaches relative to the removal of material.

Through transactions of the Board there has been paid into the treasury of the Commonwealth during the past year, from rents, licenses and sales of land, the aggregate sum of \$203,560.42.

During the year the Board made 16 new contracts* duly authorized for the expenditure of \$124,181.02.

Sales and leases have been made as follows:—

On June 12, the Board executed a bond for a deed of conveyance from the Commonwealth to James Richard Carter, William B. Rice and Andrew G. Webster, of 43,068 square feet of land on the Commonwealth flats at South Boston, lying between Summer Street, C Street, Fargo Street and B Street, at the rate of \$2 per square foot.

On June 15, the Board leased † to the firm of Curran & Burton, for a coal yard, 267,320 square feet of land on the Commonwealth flats at South Boston, northerly of Summer Street and westerly of and adjoining land of the Commonwealth, leased to the Metropolitan Coal Company; also two pile piers to be built by the Commonwealth in front of said lot, 400 feet long, for a term of five years, from Oct. 1, 1900, with the privilege of renewal for the further term of ten years, at a rental of \$6,750 per year. On Dec. 26, 1900, an agreement was made between the Commonwealth and this firm whereby an additional yearly rental of \$250 is to be paid, in consideration of the extension by the Commonwealth of one of the piers referred to in the lease of June 15, and the execution of certain dredging in connection therewith.

On November 6, the Board executed a bond for a deed of conveyance from the Commonwealth to the firm of Brown & Wales of two corner lots, containing 26,500 square feet, on the Commonwealth flats at South Boston, in the block bounded by Egmont, C, Fargo and D streets, at the rate

* See Appendix A.

† See Appendix B.

of \$1.40 per square foot. This bond also covered the right of purchase from the Commonwealth of two other adjacent inside lots within this block, at the rate of \$1.25 per square foot.

COMMONWEALTH TIDE LANDS.

On February 6, a license was granted to the Edison Electric Illuminating Company of Boston to extend its wharf on Fort Point Channel, in the city of Boston, to the harbor line established by chapter 170 of the Acts of 1880. The Board recommended the payment of \$13,591.05 by this company for the rights and privileges granted in tide-water land of the Commonwealth to be covered by the proposed extension, the area being 8,237 square feet. This amount was determined by the Governor and Council, Feb. 14, 1900, under section 16 of chapter 19, Public Statutes, to be a just and equitable one to be paid therefor. Payment of this amount was made by the company Aug. 9, 1900.

On October 24, a license was granted to the trustees of the Boston Real Estate Trust to extend their wharf on Fort Point Channel, adjoining the northerly side of Congress Street in the city of Boston. The Governor and Council determined, on Nov. 7, 1900, that \$29,373, the amount recommended by the Board, should be paid for tide-water land of the Commonwealth to be covered by the proposed extension, the area being 7,389 square feet. Payment of this amount was made by the trustees Nov. 27, 1900.

The above amounts were paid into the harbor compensation fund for Boston harbor, under chapter 146 of the Acts of 1897, the income of this fund being available for use by the Board in improving Boston harbor.

BOSTON HARBOR.

The attained supremacy of this country in the production of coal, iron and steel, which are the fundamental materials of modern commerce and industry, — the output of coal and iron during the past year having been one-third of that of the world, — inspires confidence in the belief of a great future for the exports of Boston. In twenty years the export

of iron and steel from the United States has risen from \$14,714,524 in 1880 to \$121,858,344 in 1900. The export of other products is also increasing with great rapidity. During the same period all exports from Boston have grown from \$59,238,341 in 1880 to \$112,195,555 in 1900.

In all this great increase of exports from this country, that of manufactured goods has surprised the world. It is reasonable to expect this yearly growth to continuously advance, and the proportion of it which will be sent abroad from the port of Boston will depend largely upon the accommodations and facilities there afforded. Vessels in the foreign trade entering and clearing from Boston in 1900 aggregated 4,225,000 tons, while vessels in the coastwise trade numbered 21,000 and aggregated 17,000,000 tons.

The consolidation of railroad interests at Boston which has been consummated the past year under legislative authority will not only enlarge the resources and means for convenient accommodation, but is expected to greatly increase the volume of exports. Under these conditions, the improvement of the harbor by widening and deepening its main channels navigable for the large steamships employed in trans-Atlantic traffic becomes an imperative necessity.

Boston has for many years been the second port in importance in the country. The customs revenue collected during the year ending June 30, 1900, was nearly \$19,000,000. The Federal government, in recognition of its value and usefulness, has been and is spending not inconsiderable sums in the improvement of the harbor. At the present time the main ship channel has been excavated to a depth of 27 feet at mean low water, with a width of 1,000 feet from the entrance of the harbor to President Roads, excepting about 250 feet on the southern side between Georges and Lovells islands, where some rocky ledges still exist, although, however, about to be removed.

From President Roads to Constitution wharf a width of 500 feet has been dredged to the depth of 27 feet along the northerly side of the proposed channel throughout its length. In doing this work a ridge of ledge was uncovered extending across the channel at the upper middle. Through this a cut

250 feet wide has already been made, to the depth of 27 feet, and the balance is being removed as rapidly as possible. The authorities are now at work dredging the additional 500 feet on the south side, in order to give the channel throughout the projected width of 1,000 feet, with a depth of 27 feet.

Long before the anticipated completion of this project, Congress realized that the increased and increasing size of ocean steamships would require still deeper and wider channels. A modified project was thereupon developed, under suggestions having a home origin, for creating a new entrance to the lower harbor through Broad Sound, following the line of the existing channel now used by small craft coming from the east.

This project called for a ship channel out through Broad Sound 30 feet deep and 1,200 feet wide. The necessary authorization was secured, and under an appropriation by Congress at its last session the work is partially done, but will require at least another season for its completion, as dredging cannot progress there in the winter months.

It is estimated that the appropriation already made is sufficient to complete the dredging, but an additional appropriation of \$133,000 (the balance of the amount authorized to be expended on this channel) will have to be made for the removal of the ledges which will be uncovered by the dredging.

So rapid has been the increase in the size and draft of the ocean steamships of late, that before the contract relating to Broad Sound Channel for a depth of 30 feet and a width of 1,200 feet was signed, a demand arose for still greater enlargement. Members of this Board, accompanied by leading merchants of Boston, in April last, visited Washington, appeared before the committee on rivers and harbors of Congress, and requested that steps might be taken for securing to Boston a ship channel from the wharves to the sea, having a depth of 35 feet and a width of 2,000 feet. The act of Congress approved June 6, following, provided for a survey of Boston harbor, with a view to providing channels 2,000 feet wide, or such width as may be necessary, and 35 feet

deep, from the Navy Yard at Charlestown and the Chelsea bridge and Charles River bridge to President Roads, and from President Roads through Broad Sound out to the ocean.

In the scant time which has elapsed since the passage of that act, the United States engineer officer for this district has caused surveys and estimates to be made and forwarded to Washington, in order that the committee on rivers and harbors at its December sitting may have before it the data for determining the appropriation necessary to be inserted in the river and harbor bill, which it is expected will become a law before the expiration of the present session of Congress, on March 4, 1901.

Should Congress make provision at its present session for carrying out the above project for enlarging the channels in Boston harbor, by approving a channel 1,500 feet wide and 35 feet deep from Broad Sound to President Roads, and 1,200 feet wide and 35 feet deep up to the first bridges, at a cost of about \$8,000,000, there is every reason to believe the work will begin during next summer and progress as rapidly as may be until finished. Such a work would require several years for completion, but, for convenience, may be prosecuted in longitudinal sections so as to give the necessary depth of 35 feet throughout the entire length of the project at a comparatively early date, while the full width proposed for the accommodation of commerce will be sure to be realized later. We may, therefore, with confidence look forward to the ultimate completion at this port of channel facilities adequate to the growing demands of commerce.

In thus making provision for the growth of the port by improving the navigable channels of the harbor, Congress will be pursuing the established policy of the government, in carrying out which hundreds of millions of dollars have already been appropriated, whereof \$4,080,027.10 only has thus far been appropriated for the improvement of the harbor of Boston. It would be trenching on the sphere of duty of the national government for the Commonwealth to undertake expenditures for improving the main ship chan-

nels of any of her commercial harbors. Her efforts in that direction should be confined to urging favorable action on the part of Congress.

During the past half-century, in which questions relating to the preservation and improvement of Boston harbor have been studied and reported upon from time to time by commissions of able experts, the Commonwealth has freely appropriated money for such further improvements and aids to navigation in the way of removing shoals, dredging in compensation for tide water displaced, and providing enlarged accommodations such as do not plainly fall within the scope of Federal action. The total amount so spent during the past twenty-five years under special appropriations of the Legislature aggregates \$1,560,698, and more yet will be required as accessory to the projects of the national government for making Boston a first-class port, if she is to be provided with every modern facility for competition in the transportation problems.

An appropriation was made by the last Legislature for the purpose of removing shoal spots off the wharves opposite the Hoosac Tunnel docks, which had become a growing interference with navigation by the large steamships of the Dominion line. In June a contract was awarded the Eastern Dredging Company, and eighty-nine thousand two hundred and ninety-two cubic yards of material have been removed and the bottom of the harbor deepened over an area extending from off the Boston Gas Company's wharf as far down as off Fiske's wharf. The cost of this work was \$20,622.69, whereof \$15,000 was expended under the provisions of chapter 309, Acts of 1900, and the balance from the income of the harbor compensation fund. Before improvement, the shoalest places were only 16.5 feet below mean low water, and dangerous to the loaded steamships sailing from the Hoosac Tunnel terminal.

In 1860, the average size of iron steamships built and registered in the United Kingdom was 340 tons; in 1899 it had increased to 1,940 tons. Meanwhile, experiments had shown that greater breadth could be obtained without diminution of speed, wherefore the relative proportion of

breadth to depth was largely increased. It was ascertained, in the study of economical water carriage, that, if draft could be deepened proportionately to increase of dimensions, the cargo could be carried at a steadily decreasing cost, as size increased. Experiment, therefore, may be expected to go on until the true limit of profitable carriage, controlled by the factors of economy, speed, capacity and safety, is reached. Until then it cannot be foretold how deep to plan the channels from the docks to the sea.

Enough has been said to indicate good reason for the frequent changes in projects for deepening and widening harbor channels.

With a view to obtaining the fullest enjoyment of water front accommodation compatible with a preservation of all necessary harbor areas, it may become desirable to make alterations in portions of the harbor line at Charlestown and East Boston.

WINTHROP CHANNEL.

The harbor has also received the benefit of the income of the compensation fund in other directions. Early in the summer the attention of the Board was called to the fact that the channel leading from the main harbor to the wharves in Winthrop was so shoal in certain portions that passenger steamers grounded often from two to three hours at extreme low water, causing vexatious delays to the passengers.

Upon investigation, it was found that a section of the channel below the basin opposite the Winthrop Yacht Club House had been dredged through a bank of solid clay; above and below this section the bottom was soft mud. When the channel was originally dredged, owing to the hard material, the dredging was not carried below the required depth of eight feet at mean low water. Where the bottom was soft, excavation was carried to a somewhat greater depth. In order to improve the channel so that the delays would be reduced as far as possible, at a small outlay, it was decided to dredge an additional depth through the hard clay section. For this purpose 4,550 cubic yards of material were removed. This was done prior to June 15, on which date the steamers began to run.

SHIRLEY GUT.

During the year complaints were made to the Board that the shoaling in Shirley Gut was increasing, and that it was growing more and more difficult to navigate. A survey was made in May, and it was found that the low water line and bank below it had grown out into the Gut about 25 feet, just east of the narrowest point.

Later in the year the city of Boston decided to lay an additional water pipe across the Gut, just south of the metropolitan sewer. In order to lay this below the depth to which it was desired to excavate the Gut for purposes of navigation, it was found necessary to dredge a certain amount of material from the Gut on the southerly side of the sewer, and 2,271 cubic yards were removed.

This is all the dredging which will be required south of the sewer syphon under the plans of the commissioners, but, in order to make navigation through the Gut as safe as it is practicable with the sewer syphon in its present location, it will be necessary to remove about 10,000 cubic yards on the northerly side of the syphon, thereby cutting off a small area from the extreme end of Point Shirley.

ANCHORAGE IN BOSTON HARBOR.

By chapter 97 of the Resolves of 1900 the Board was directed to cause examinations, surveys, plans and estimates to be made, to determine the feasibility and cost of providing additional anchorage ground in Boston harbor. A preliminary study of the question was made from the plans and information on file in the office, and conferences were held with the harbor master * and others having special qualifications and interested in the navigation of the harbor.

The causes which led up to the present demand are largely the increase in the size and draft of vessels seeking an anchorage in the harbor, as well as the great reduction in area available for anchorage on the flats, occasioned by the improvements at South Boston and in other places. Formerly a large number of the vessels were of such size and draft that

* See letter of harbor master, Appendix C.

they could safely anchor in comparatively shallow water, and the area of flats on both sides of the main channel was available, but limited. As the character of the vessels changed, increasing in size and draft, the tendency has been to anchor them nearer and nearer to the channel, in order to keep them afloat at all times. In the improvement of the South Boston flats the Commonwealth dredged a large area of the shoal flats lying outside of the harbor line, and thereby added a number of acres to the deep water anchorage. While this has served to accommodate a great many vessels, the increase in area has not kept pace with the demand. It has also been necessary, owing to the growth in the number and size of steam vessels plying in the harbor, to push the anchorage farther away from the wharves. The size of the steamships requires the keeping open of a greater width of channel for their use. All these causes have combined to restrict the area available for anchorage.

In studying the question of the location for suitable anchorage, the choice has been somewhat restricted, as it is desirable to have it near to the city wharves. The area also should have a depth of not less than 30 feet at mean low water. With these limitations, two areas only seem to be at all suitable, one on the south and the other on the north side of the main channel, just above Governor's and Castle islands. The area on the south side is bounded on the east and south by Castle Island and the Marine Park; on the north by the main ship channel; and on the west by what is known as the temporary entrance to the Reserved Channel of the South Boston flats. As the result of soundings which had been made, and from prior knowledge that in the main ship channel immediately in front of this area ledges had been found at a depth of less than 23 feet at mean low water, this location was rejected.

The second area lies broadside between the main ship channel and Bird Island flats, and extends lengthwise from the narrow channel west of Governor's Island to the area dredged in 1896 in front of the Grand Junction wharves. Careful surveys have been made and soundings taken over this locality. In addition, 37 selected borings have

been made, to the depth of 40 feet below mean low water. No ledge has been discovered. The centre of Bird Island shoal was found to consist of a hard pan of sand, clay and boulders, while under the deeper water lying south of the shoal and between it and the main ship channel the bottom consists of silt and clay. In order to accommodate the largest possible number of vessels, it is proposed to excavate, to the depth of 30 feet at mean low water, an area about 1,000 feet wide and about 5,000 feet in length, lying along the northerly edge of the main ship channel from the deep water opposite the Leyland Line slips to the cross channel between Bird and Governor's islands, and then to fill solid within a sea wall or bulkhead on the eastern portion of Bird Island, the southerly side of which should be distant 1,400 feet from the northerly side of the main channel. From this solid filling a series of narrow pile piers are to be extended toward the channel, to which a large number of steamers, schooners, coal barges, etc., may be moored. Here they would take up but a small fraction of the room required by them to swing at anchor in the harbor.

A plan is appended exhibiting the project in detail, at a cost estimated not to exceed \$1,000,000.

If the foregoing project should meet with the approval of the Legislature, before entering upon the same, the municipality of Boston, being the owner of Bird Island flats, should release the same to the Commonwealth.

The advisability of dredging the entire area of Bird Island flats to a depth of 30 feet for the purpose of an anchorage basin has been carefully considered, and rejected, for, among others, the following reasons:—

The expenditure required would be at least double that of the project recommended.

The anchorage basin thus created would not accommodate as many vessels swinging at anchor as could be moored in the way proposed, and the protection afforded would be less.

The effect on the direction, volume and velocity of the currents, which on the ebb tide now scour the main ship channel, by resultant deflection of any portion thereof into

Governor's Island channel to the north, cannot even approximately be estimated.

The national government is about making a liberal expenditure for deepening and widening the main ship channel, and such local action tending to diminish the scour in that channel, or even the advocacy of the measure, would be likely to be viewed with distrust, even if it did not jeopardize the improvement. At present Bird Island acts to some extent as a training wall, and its influence in that direction should not be disregarded.

THE COMMONWEALTH FLATS AT SOUTH BOSTON.

Under this title is comprised about 170 acres of filled land, of which about 70 acres lie north of Summer Street and the balance to the south of it.

Summer Street, which was completed and turned over by the city engineer to the street department of Boston in December, 1900, extends across Fort Point Channel and lands of the Boston Wharf Company, and over the tracks of the New England Railroad at an elevation of 24 feet above the road-bed, thence descending on an incline of $11\frac{1}{2}$ per cent. to grade at a point about 300 feet west of its intersection with E Street.

Summer Street and its approaches have been built in a thorough manner. The roadway has been paved throughout over the bridges, as well as on the solid portions of the avenue, with granite blocks; the sidewalks of the bridges have been paved with asphalt, and across the Commonwealth's property have been coated with broken stone, which makes a good surface. The necessary drains and catch-basins have been built to give the required surface drainage, and sewers for house drainage are now in process of construction at the eastern end of the street. These will connect with the new brick sewer which has just been completed in E Street.

The opening of this new avenue to public travel will attract additional attention to these lands of the Commonwealth. Sales and leases, as appear on page 4 of this report, have already been made to parties who will occupy and improve the property.

It is essential to the proper development of this large area that convenient railroad accommodations should be provided up to the warehouses and buildings where the business for which this location is peculiarly well adapted is destined to be carried on.

COMMONWEALTH PIER.

The work on the large pier which has been under construction for the last three years, having been authorized by chapter 513 of the Acts of 1897, has been pushed forward as rapidly as possible. The core or solid portion was finished last year, and a contract was made with George A. Cahill, March 6, 1899, for building the oak pile platform, 50 feet wide, surrounding this solid core. This contract provided that the work should be completed July 1, 1900; owing, however, to difficulties experienced by the contractor in getting the long oak piles required for the outer portion of the platform, the work has been delayed, but has now progressed so far that it will probably be wholly finished early in the coming spring.

In order to obtain material for filling the solid portion of the pier, the dock on the westerly side was excavated to the depth of 30 feet at mean low water for its full width, 175 feet, on the Commonwealth's property throughout a distance of 450 feet from the harbor line. The inner portion of this dock was excavated to the same depth for a width of 100 feet adjoining the face of the platform. Beyond and across the outer end of the pier the excavation was carried to the same depth for a distance of 70 feet from the harbor line. Between this and the main ship channel there is a depth of 23 feet at mean low water, which had previously been dredged by the Commonwealth. In the dock on the easterly side of the pier very little dredging has been done beyond what was required in preparing the foundation for the sea wall. The surface of the solid portion of the pier is now at grade 14 feet above mean low water and about 3 feet below the level of the floor of the pile platform, the intention being to floor over the solid portion with timber, leaving spaces for the car tracks on the present solid fill, or to raise the whole surface with a filling of clean gravel. The

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filling already in place consists of clay dredged from the harbor.

The cost of the work up to December 1, from the appropriation of \$400,000, has been as follows:—

For solid portion,	\$215,076 30	
Surveys and supervision, . .	9,633 69	
	<hr/>	\$224,709 99
Pile platform construction, . .	\$82,835 78	
Surveys and supervision, . .	2,053 25	
	<hr/>	84,889 03
Total,		<hr/> \$309,599 02

The amount required to complete the work now under contract is estimated to be \$50,000.

Before the pier is available for business it will be necessary to complete the excavation of the dock on the westerly side, also to excavate a dock on the easterly side, and also to floor over the solid portion of the pier and erect such sheds or other buildings as may be required; but plans and estimates cannot be made for this work until it is definitely known to what use the pier is to be put.

In accordance with the agreements contained in the lease to Curran & Burton, heretofore referred to, of the land adjoining that leased to the Metropolitan Coal Company, the Commonwealth has built a pier 448 feet long and 35 feet wide, with oak piles and hard pine timber; also a pier 400 feet long and 10 feet wide, with an ell at the end 15 feet by 20 feet, of spruce piles and timber; and has also done all dredging necessary to accommodate the coal vessels. The dredging provides a berth on the easterly side of the larger pier 18 feet deep at mean low water and a berth between the two piers of 12 feet, beside extending these berths beyond and connecting them with the channel from the Metropolitan Coal Company's wharf to deep water. This channel, in order to accommodate the two properties, has been widened to 100 feet on the bottom. The larger pier is built to sustain the equipment necessary for discharging and loading vessels, while the smaller has a bulkhead throughout its length, to prevent wave action from reaching the docks.

In order to properly care for surface and surplus water upon the area leased, a drain, consisting of salt-glazed sewer pipe, connected with wooden catch-basins, has been built lengthwise through the property.

The foregoing has been built in a satisfactory manner, at a total cost not to exceed \$32,300. The lessees have taken possession, and are erecting the necessary plant for rehandling and delivering coal.

BULKHEAD.

For a number of years past the material which has been dredged in connection with the various operations on the Commonwealth flats and which was not required for filling in other places has been deposited on the flats east of the 70-acre lot. The material so deposited, although placed as compactly and as high as was practicable, extended so far out from the existing bulkheads, that, in view of the fact that a place of deposit would be required in the near future for a large amount of material to be dredged from the docks at the new pier, the Board decided to build a bulkhead 1,000 feet long on the northerly side of the area, to enclose the filling and prevent its being washed down by the waves to the injury of the harbor.

A contract was made, June 1, 1900, with Augustus Bellevue & Co., the lowest bidder, to build the bulkhead for the sum of \$11.18 per lineal foot. Up to Dec. 1, 1900, about 600 lineal feet had been built, and work is now progressing on the remainder. As a stronger and more substantial bulkhead than usual was deemed advisable, it is being constructed of oak piles, the thickness of the planking being increased from 3 inches to 4 inches, and the stringers or waling of southern pine instead of spruce, which had formerly been used. The cost up to Dec. 1, 1900, is as follows:—

Paid for construction,	\$6,414 02
Supervision and surveys,	216 08
	<hr/>
	\$6,630 10

To complete the work now under contract will cost about \$5,000.

In order to fully enclose the territory in rear of this bulk-head, it will be necessary during the coming season to extend the sea wall on the northerly side of the Reserved Channel, which forms its southerly boundary.

During the past year about 18,000 loads of filling, principally taken from street and cellar excavations in the city proper, have been brought to the flats and levelled in place.

B STREET.

B Street was laid out 80 feet wide by the street commissioners of Boston, and approved by the mayor, December, 1899.

E STREET.

The city of Boston has constructed a brick sewer throughout the whole length of E Street from First Street to Summer Street. Early in August notice was received from the street commissioners that they proposed to lay out E Street from First Street to Summer Street, and a hearing was held at their office, Aug. 23, 1900.

NORTHERN AVENUE AND BRIDGE.

The Board feels impelled to again bring to the attention of the Legislature the necessity for building Northern Avenue and Northern Avenue bridge across Fort Point Channel below Congress Street bridge. It was included in the first project for developing the Commonwealth flats at South Boston, more than one-third of a century ago. Provision was made with a view to building Northern Avenue and bridge, in a four-part agreement, entered into between the Commonwealth, the Boston & Albany Railroad Company, the Boston Wharf Company and the city of Boston in 1873, which planned for the filling of territory, laying out streets and otherwise improving the district, to the advantage of those interested therein. For many reasons there has been delay in carrying out the terms of this agreement, and the Commonwealth has waited with patience. In the report of this Board for the year 1898, page 10, the situation, which is substantially unchanged, was stated as follows:—

Under the four-part agreement of 1873, great benefits were expected to ensue to all the parties thereto.

At present the city has added to her territory 170 acres of land filled to grade 13, with streets gravelled to grade 16, and has secured the right, without incurring land damages, to lay out and construct the streets and sewer the same, in readiness for sale and improvement, whereby a large increase of taxable property will surely become assessable for the benefit of her treasury.

During the period since 1873 the Boston Wharf Company has increased the value of its property more than five-fold; and the railroad interest has not only received all contemplated benefits and even more, but has so intrenched itself in its possessions as almost to defy the right of the city and the Commonwealth to have Northern Avenue cross its grounds.

The Commonwealth seems to be the only party to that agreement to whom the contemplated benefits have failed to materialize.

The agreement provides, among other things, that the city will, within twelve months after the request of the Board of Harbor Commissioners, approved by the Governor and Council, build Northern Avenue bridge, at a cost not to exceed a fixed sum.

The city agrees that, in case it shall fail to build the bridge and extend Northern Avenue, the Commonwealth may build said bridge and extend said avenue; and that the city will pay all reasonable expenses, not exceeding the limit fixed, which the Commonwealth shall incur in building the bridge and avenue.

Further, the Commonwealth and the railroad company agree that the city may lay out Northern Avenue not more than 100 feet wide across the railroad land and tracks, without liability for land damages.

Still further, it is agreed that the city shall be subjected to no grade or other damages for any land taken or any injury done to land of either of the parties, the Commonwealth, the railroad company or the wharf company, on the south-east side of Fort Point Channel, in performing its obligations under the indenture.

The conditions precedent to the right of the Commonwealth to call on the city to fulfil its part of the contract to lay out Northern Avenue and build a bridge have been complied with.

In March, 1898, the city was served by the Board of Harbor and Land Commissioners with the prescribed request, approved by the Governor and Council, to build Northern Avenue bridge.

No action, however, has been taken.

The Legislature, by chapter 535, Acts of 1896, which

authorized the elevation of the Summer Street extension across the tracks of the New England Railroad, and prohibited the crossing of those tracks by any street or by any other structure between West First Street and the proposed location of Northern Avenue, — a distance of seven-eighths of a mile, — expressly recognized the four-part agreement, and compelled the recognition of its vitality by the railroad company and the city, in section 10 of said chapter 535, as follows, to wit: —

The acceptance of the provisions of this act by the New England Railroad Company and the city of Boston by any proceedings thereunder shall be and in any court shall be construed as a waiver by them respectively of any objection to the validity of or defence to the enforcement of any and all of the provisions of the agreement of the twenty-fourth day of June in the year eighteen hundred and seventy-three, between the Commonwealth, the Boston & Albany Railroad Company, the Boston Wharf Company and the city of Boston.

The city long since acquired the wharf and way at the end of Oliver Street contemplated as the western terminal of the bridge in connecting with Atlantic Avenue, and continues to hold it.

The Commonwealth pier at South Boston, as before stated, is nearing completion, and will prove of little use unless a proper approach is made to it from the centre of business activity. It might have been leased before this had the Board been able to give any definite promise of a street connecting it with the thoroughfares of the city.

This Board has heretofore repeatedly urged the necessity of making provision for an avenue of approach, with the hope that it might be undertaken early enough to be finished when the pier should be ready for use.

Should the building of Northern Avenue and bridge now be authorized, their construction would still be a long way behind the completion of the pier. Under these conditions legislation cannot be too urgently pressed to either compel the city of Boston to build Northern Avenue and Northern Avenue bridge across Fort Point Channel under the terms

of the four-part agreement, or to authorize the Board of Harbor and Land Commissioners to build the same, and charge to the city its proportion of the cost thereof, according to said agreement.

The large interests of the Commonwealth in its lands at South Boston and the important commercial results depending upon a proper and convenient approach to its costly pier demand decisive action.

THE COMMONWEALTH FLATS AT EAST BOSTON.

There has been no material change in the above-named flats since the last report. The suit for damages for taking the flats by the East Boston Company is still pending.

Under the terms of chapter 468 of the Acts of 1900, being an act to authorize the lease of the Boston & Albany Railroad to the New York Central & Hudson River Railroad Company, the parties have executed the proposed lease. By section 6 of that act, the lessee was required to expend "not less than \$250,000 in each year, beginning not later than the first day of July in the year 1901, . . . in extending, enlarging, improving and developing the terminal facilities of the lessor in that part of Boston called East Boston and upon the Grand Junction Railroad . . . and for approaches to the property taken by the Commonwealth at East Boston for the purpose of constructing thereon wharves and docks."

When definite action shall be taken with reference to this authorized expenditure, it is to be hoped that the improvement will result in locating the tracks of the Boston & Albany Railroad and the Boston & Maine Railroad over upon the east side of East Boston, at or near the location of the Boston, Revere Beach & Lynn Railroad, as has been outlined in prior reports of this Board, and provided for in chapter 462 of the Acts of 1900.

Until plans shall be definitely matured by the railroad company with reference to the relocation of its tracks in East Boston, it would be premature to formulate plans for the development of the East Boston flats of the Commonwealth.

FORT POINT CHANNEL.

Fort Point Channel and South Bay are important avenues of approach for vessels into the heart of the city. The depth of water has been increased from time to time to about 10 feet in the channels of the bay, 23 feet up to Summer Street bridge and 16 feet to Federal Street. The draw opening of the Summer Street bridge has a width of 50 feet, and the property owners on the channel are desirous of having the draw openings in Congress Street and Mount Washington Avenue bridges enlarged to the same width, as many cargoes are now discharged from steamships into lighters, when the goods should be landed directly on the wharves abutting on the channel.

The city of Boston has in contemplation the erection of a steel bridge with masonry piers in place of the existing pile bridge at Congress Street. A draw opening at least 50 feet wide in this new structure should be required.

Mount Washington Avenue bridge might be wholly removed with benefit to navigation, and with but comparatively small inconvenience to the public.

On July 10, 1900, the Secretary of War, in pursuance of a report made by a special board of army officers, authorized the construction of Cove Street bridge across the channel. This will be located between Federal Street bridge and the main bridge of the New York, New Haven & Hartford Railroad, in accordance with plans approved by this Board last year, and referred to in its report.

On Sept. 7, 1897, the Board licensed the city of Boston to build a street or way on the pierhead line between Summer Street and Congress Street on the west side of Fort Point Channel. The petition of the city was based upon a decree of the superior court, dated March 13, 1897, accepting a report of its commissioners appointed under chapter 535 of the Acts of 1896, to abolish the grade crossing at Congress Street, which decree required the city of Boston to build on the location described in the license a street to be filled solid with suitable filling, supported where necessary by a sea wall. Subsequently to issuing this license the

Boston Electric Light Company and the trustees of the Boston Real Estate Trust requested the Board to issue licenses to fill, without compensation for tide water displaced, on their respective properties inside of said proposed street, contending that the structure to be built by the city of Boston under the decree aforesaid of the court and the license of the Board must be substantially water-tight, and consequently no tide would ebb and flow over their premises to be displaced by their proposed filling.

The Board decided that, while the city of Boston was licensed to fill solid, the decree of the court did not require the structure to be built so as to exclude the inflow and outflow of tide water, and that therefore if a license were granted to the parties, while a tide ebbed and flowed in fact over their land, they must be charged with payment of compensation under the statute.

The counsel for the parties, being dissatisfied with the decision of the Board, asked that the opinion of the Attorney-General be taken thereon, stating that they would abide by his decision, which should be final. The Attorney-General sustained the decision of the Board, in the following opinion:—

Boston, July 21, 1900.

Hon. WOODWARD EMERY, *Chairman,*

Board of Harbor and Land Commissioners.

DEAR SIR:—Your letter of June 6 submits the question whether, upon the facts stated in the documents accompanying the letter, the Boston Electric Light Company should be required to make compensation for tide water displaced by the filling of flats under a license from your Board. The facts, as far as they are material to the questions raised, appear to be substantially as follows:—

By a decree of the superior court, duly entered upon a petition for the abolition of certain grade crossings on Congress Street, the city of Boston was directed, among other things, to build upon certain flats, a part of which at that time belonged to the Boston Electric Light Company, a way, being a part of what is now Dorchester Avenue extension. The terms of that part of the decree relating to this way were as follows: “Tenth. The first approach leading from Atlantic Avenue to said new street shall be filled solid with suitable filling, supported, where necessary, by a sea wall, and shall have a roadway paved and curbed with granite

60 feet wide, with a sidewalk on each side 10 feet wide, paved with brick."

As this work was required to be built over tide waters, the city of Boston applied to your Board for a license therefor. Their petition was filed in May, 1897, and was for a license to build "a sea wall on the pierhead line, between Summer Street and Congress Street, and along the line of widening of Congress Street, and to fill back of said wall." In September, 1897, your Board issued a license authorizing the city of Boston "to build a sea wall on the pierhead line between the northerly side line of Summer Street extension and the northerly side line of Congress Street as widened to 80 feet, and on said northerly side line of Congress Street as widened, from said pierhead line to the sea wall of the Boston Real Estate Trust; also to fill solid back of said sea wall, in conformity with the accompanying Plan No. 2043." In conformity to these decrees the city of Boston has built, or is building, a solid structure. It has, however, constructed viaducts in said structure, through which the tide ebbs and flows upon the flats in the rear thereof. These flats belong to the Boston Electric Light Company.

The precise question submitted by your letter is whether the displacement of tide water which will be occasioned when the flats of the Boston Electric Light Company are filled should be paid for by the city of Boston, or by the Boston Electric Light Company. The contention of the latter company is that inasmuch as both the decree of the superior court and the license of your Board specify a sea wall and a solid filling for the structure to be erected by the city of Boston, the land in the rear must necessarily be thereby cut off from the ebb and flow of the tide, so that there would be no longer any displacement of tide water caused by the filling of the flats of the company; and that the city of Boston should pay for all the tide water which would be displaced by the structure built by it as a solid structure, impervious to the flow of the tide.

There can, of course, be no question that if such a structure were built under license from your Board which would cut off all the land in the rear from the ebb and flow of the tide, the displacement to be paid for by the party erecting such a structure would include not merely the territory covered by the structure, but all the flats in the rear so separated from the ebb and flow of the tide. The language of the statute (Pub. Sts., c. 19, § 14) is as follows: "The amount of tide water displaced in tide water below high-water mark, or by any filling of flats" etc. The section further provides that the annual income from all fees for compensation for tide water displaced shall be expended by your Board for the

improvement of the harbor. The purpose of the section was clearly to require persons lessening the volume of tidal flow over flats adjacent to a harbor to contribute in proportion to the amount of such lessening to a fund for the improvement of the harbor. A solid structure, impervious to water, would lessen the amount of flow, not only upon the portion of the flats covered by the structure, but upon all the flats from which the water was thereby kept; and the compensation to be paid by the party building such a structure should be ascertained in view of all such displacement.

The difficulty with the contention of the Boston Electric Light Company is that it interprets the words "filled solid," which occur several times in the decree, and are used in the license of your Board, to mean a filling which is effectual to shut off the flow of water. Unless the word "solid" necessarily imports such a meaning, this interpretation is not warranted by the language of any part of the decree or of the license. On the contrary, referring to another part of the work, the decree requires the building of a wall of stone laid in cement, which obviously would be a water-tight structure. It does not follow that a sea wall, or even a solid structure, is impervious to the ebb and flow of the tide. On the contrary it is a matter of common knowledge that in the case of loosely built stone walls the water flows through almost as readily as through a pile structure.

The language used both by the court and by your Board in my opinion has reference, not to the question of imperviousness to water, but rather to the character of the structure for the purposes for which it is to be used. Two kinds of structures are in common use in tide waters. One is a solid filling; the other a structure supported by piles. When the term "solid" is used with reference to a structure to be constructed in tide waters it is, unless words are used which clearly require a water-tight structure, to be taken to mean a structure built up solid from the bottom, in contradistinction to a pile structure.

There was nothing either in the decree of the court, or in the license of your Board, which required the city of Boston to make its structure impervious to water; and unless, for reasons which have no reference to the case of the Boston Electric Light Company, your Board saw fit to direct otherwise, it might properly provide for the passage of tide water through the sea wall and filled roadway without disobeying the essential terms of the decree or of your license.

But however this may be, the situation as to the Boston Electric Light Company, so far as it concerns its obligations under the law, is very simple. It is in possession of flats over which the tide

water ebbs and flows. It seeks permission to fill those flats and thereby to displace a corresponding amount of tide water which actually flows upon its premises. It is not a party to any questions which may arise between your Board and the city of Boston, or between the court and the city, and cannot set up the city's acts to support its claim that it should not pay for the displacement which its filling actually causes.

For these reasons, I am of the opinion, that your Board may properly determine that the Boston Electric Light Company should pay for the amount of tide water actually displaced by it by filling its flats.

Yours very truly,

HOSEA M. KNOWLTON,
Attorney-General.

CHARLES RIVER.

During the past year the old Charles River bridge has been wholly removed, and the draw pier of the Charlestown bridge extended to its full length below the bridge.

The old West Boston bridge has been removed, and a contract for a portion of the foundations of the new bridge, to be called "Cambridge," has been let and the work is now under way.

In December, plans for the new Cambridge bridge across Charles River between Boston and Cambridge, with a draw therein, under the provisions of chapter 467 of the Acts of 1898, were presented to the Board for approval. These plans were approved Jan. 9, 1900.

By chapter 180 of the Acts of 1899, the Cambridge bridge commission was authorized to construct this bridge, with the consent of the United States government, without a draw.

The following act was passed by Congress March 29, 1900, authorizing the construction of a drawless bridge:—

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Cambridge bridge commission be, and hereby is, authorized to construct a drawless bridge across the Charles river, in the state of Massachusetts, between the cities of Boston and Cambridge, as provided for by chapter four hundred and sixty-seven of the acts of eighteen hundred and ninety-eight, and chapter one hundred and eighty of the acts of eighteen hundred and ninety-nine, of the legislature of the state of Massachusetts; said bridge to be at least

twenty-six feet above mean high water over the main ship channel, and the piers and other obstructions to the flow of the tide to be constructed in such form and in such places as the secretary of war shall approve: *provided*, that the state of Massachusetts, within a reasonable time after the completion of said bridge, by legislative enactment, shall provide for adequate compensation to the owner or owners of wharf property now used as such on said river above said bridge, for damages, if any, sustained by said property by reason of interference with access by water to said property now and hitherto enjoyed, because of the construction of said bridge without a draw.

On May 25, plans for a drawless bridge, submitted to the Board by the Cambridge bridge commission, were approved, and license issued in substitution for plans and license approved Jan. 9, 1900.

In the approval of the plans the Board required that, "before placing the spans upon the piers, a channel to a uniform depth of not less than 10 feet at mean low water shall be dredged 50 feet wide between the piers of the central span and thence southerly 2,350 feet and northerly 500 feet, 150 feet wide, in order that the main ship channel may be continued through the bridge at the general depth elsewhere existing. The central span over the channel shall have a clear head room not less than 26 feet in height above mean high water for a distance of at least 25 feet either side of the centre line of the channel."

These plans were approved by the Secretary of War on June 5, 1900.

In the basin above Harvard bridge on the Boston side the gap in the sea wall at the entrance to the Back Bay park has been closed up, and the necessary gates and sluiceways for controlling the water in the park have been extended out to the river line.

On the Cambridge side of the river the Cambridge park commissioners have arranged to continue the filling of the park above the lands of the Charles River Embankment Company to Brookline bridge, under a license granted in August, 1900. The land owners in rear of the park have joined with the park commissioners, and will have their

marshes and flats filled at the same time as the park and by the same contractor.

The park commissioners desired permission to fill to the United States pierhead line in a location at the southerly end of the sea wall of the Charles River Embankment Company, with a view to creating an improvement of the river bank on a uniform line. The Board was obliged to refuse a license at this point, for the reason that the Commonwealth harbor line was some distance inside of the United States pierhead line in this locality. The Board is of opinion that the harbor line established by the Commonwealth could at this point advantageously be extended, and established on a line coincident with that of the United States pierhead line, and recommends the passage of an act for that purpose.

Considerable work has been done above Brookline bridge by the Cambridge park commissioners, and also by the Metropolitan Park Commissioners, during the year, with material dredged from the river under the authority of this Board, the result being both æsthetic and useful.

On May 10 the Board approved a plan, under the provisions of chapter 64 of the Acts of 1899, of work to be done at the United States Navy Yard, adjoining the property of the Fitchburg Railroad Company.

MYSTIC RIVER.

The north draw in Chelsea bridge has been widened during the year to 60 feet. The channel from the mouth of the river below the Navy Yard up through this draw, as far as Island End River, is being dredged by the United States government to the depth of 25 feet at mean low water, and is planned to be 300 feet wide. In order to obtain the increased width and depth of channel through the draw, it became necessary to remove the water pipes which connected the systems of Charlestown and Chelsea; and in replacing them it was deemed best by the Metropolitan Water Board to carry them across the channel by a tunnel which this Board required them to place not less than 40 feet below mean low water. This will keep them so far from and below the channel that they will not be interfered with by

any further deepening thereof and reconstruction of the bridge.

The city of Boston is now reconstructing Malden bridge, on piles, the width of the draw opening to be increased to 50 feet. The Massachusetts Pipe Line Gas Company has completed the tunnel for its pipes under the river at this point. The work of dredging the river above the bridge of the western division of the Boston & Maine Railroad and filling adjacent flats and marsh lands, which work is being done by the railroad company, under license from this Board, is progressing slowly.

In pursuance of its opinion, as expressed in last year's report, that, owing to the growth in demand for wharf privileges and of the limited harbor and river frontage, it would be wise to establish a regulation with reference to the width of docks, and that 50 feet should be the minimum of dock width in front of lots not less than 100 feet in width, the Board has through the past year applied this regulation, and it has been met by general satisfaction on the part of owners.

It cannot be expected that all will acquiesce in a regulation established for the public benefit, as in some instances it is bound to interfere with preconceived notions of owners as to the best method of developing their property; but, as was stated in last year's report: "The pressing necessities of adequately providing for the rapidly increasing commerce of the port of Boston and also facilitating exports of the manufactures of the Commonwealth demand the conservation of the water front to its fullest extent and its utilization to the utmost possible advantage. To these public rights it is unavoidable that private interests should yield, and submit to a proper regulation of their use."

CHELSEA CREEK.

In June, the Boston & Albany Railroad Company petitioned for a license to rebuild its drawbridge over Chelsea Creek, next above Chelsea Street bridge, between East Boston and Chelsea. The draw in the railroad bridge had an opening of 34.6 feet. The growing navigation up this inlet

seemed to require an additional width in the draw opening, and, at the suggestion of the Board, the railroad company made changes in the plan submitted, showing suitable alterations, providing for a draw opening 50 feet in width, relocating the draw piers and extending the easterly one not less than 100 feet, thus making the passageway for vessels conform more nearly with the direction of the channel.

When the city of Boston in the near future repairs Chelsea Street bridge, the draw opening will be required to conform to that in the railroad bridge, and thus assure the passage of the larger coal barges and other vessels to the wharves above.

Since granting the foregoing, a license has been applied for to construct a large wharf above this bridge, by parties who propose to use it for a lumber business. With the draw at its original width, it would have been impracticable for vessels of the size now used in the lumber business to have reached the wharf. The location is singularly well adapted, by reason of the railroad in the rear and deep water in front, for a large lumber business.

WEYMOUTH FORE RIVER.

On May 7, the Board granted a license to Thomas A. Watson to build pile wharves and bulkheads and fill solid in Weymouth Fore River and Bents Creek at Quincy Point above Quincy Point bridge, and to dredge in said creek for the purposes of a dock, also in said river adjacent to the proposed wharves, to a depth of 25 feet below mean low water.

This license authorizes the construction of 3,715 feet of wharf, measured on the outer line thereof, of which 1,165 feet will front on Weymouth Fore River, 1,675 feet on the southerly side of the dock and 875 feet on the northerly side, — a portion of the dock to be 175 feet wide. This property is to be used for ship-building purposes by the Fore River Engine Company. Work under this license is now in progress.

By chapter 456 of the Acts of 1900 the county commissioners of Norfolk County are authorized and directed, within

two years from Jan. 1, 1901, to construct a new bridge across Weymouth Fore River, substantially replacing the present Quincy Point bridge, with a draw therein, having an opening of not less than 80 feet in width. It is to be of such width, grade, material and construction as the county commissioners, with the approval of the Board of Harbor and Land Commissioners, shall deem reasonably necessary and proper.

Plans of this bridge have not as yet been submitted to the Board for approval; but upon the completion of this work, and the deepening by the Federal government of a portion of the river below, it will be possible to take battleships and other large craft from the property covered by the above license to deep water in Boston harbor.

NEW BEDFORD AND FAIRHAVEN BRIDGE.

On Dec. 6, 8, 14, 19 and 20, 1899, and Jan. 12, 17, 19, 1900, the Board met with the Board of Railroad Commissioners, acting as a joint Board under chapter 99 of the Resolves of 1899, for the purpose of considering the matter of the completion of the New Bedford and Fairhaven bridge over the Acushnet River, and preparing its report to the Legislature, as required by the resolve. This report (House, No. 278) was submitted Jan. 22, 1900.

On July 17, 1900, a petition was received from the city of New Bedford for approval of plans by the joint Board of Railroad Commissioners and Harbor and Land Commissioners, under chapter 439 of the Acts of 1900, for completing a portion of the New Bedford and Fairhaven bridge and for building a temporary bridge between New Bedford and the west side of Fish Island.

On July 24 and 26, 1900, the joint Board gave hearings on that part of the above petition relating to a temporary bridge. The city of New Bedford appeared by its mayor and special counsel, and the city engineer; the New York, New Haven & Hartford Railroad Company, the Union Street Railway Company and other property owners, by counsel. The hearing relative to plans and specifications for completing the permanent bridge was postponed to Sept. 20, 1900.

On July 26, 1900, the joint Board signed the following order and approved the plans referred to therein : —

COMMONWEALTH OF MASSACHUSETTS.

Whereas, The city of New Bedford, in the county of Bristol and Commonwealth aforesaid, has been authorized by the General Court, by chapter 439 of the Acts of the year 1900, to construct a temporary bridge over the channel of Acushnet River between the city of New Bedford and the west side of Fish Island, in the county of Bristol and Commonwealth aforesaid ; and, before beginning said work, has given written notice to the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners, constituted a joint Board under said act, of the work intended to be done, and submitted, for the approval of the joint Board, plans showing in detail the location and dimensions of said work, and the mode in which the same is to be performed ; and *whereas* due notice of said application, and of the time and place fixed for a hearing thereon, has been given, —

Now, the joint Board, having heard all parties desiring to be heard, and having fully considered said application, hereby approves the plans for said work hereto annexed, and the mode of performing the same as shown thereby, and hereby authorizes said work to be done in accordance therewith, subject to the provisions of chapter 439 of the Acts of 1900, and of all laws of the United States which are or may be in force applicable thereto.

The work hereby authorized and approved is the construction of a temporary bridge, on piles, to be built without a draw therein, across a portion of Acushnet River between the city of New Bedford and the west side of Fish Island ; also the approaches to said bridge, as shown on the plans annexed hereto, dated July 26, 1900, and signed by the joint Board.

The Union Street Railway Company shall lay its tracks upon said bridge and approaches as shown on said plans under the general supervision of the city engineer of the city of New Bedford, and operate the same as at present and under such further regulations, terms and conditions as the joint Board may from time to time prescribe.

The city is to connect the old channel of the river with the new channel north of Fish Island before constructing the temporary bridge, in accordance with a plan entitled " Location of proposed dredging by the city of New Bedford," etc., by W. F. Williams, city engineer, dated July 23, 1900, under a contract already executed.

Said temporary bridge shall be removed to the satisfaction of

the joint Board upon the completion of the permanent bridge and approaches thereto.

IN WITNESS WHEREOF, the joint Board have hereto set their hands this twenty-sixth day of July, in the year 1900.

JAMES F. JACKSON,
GEORGE W. BISHOP,
HERSEY B. GOODWIN,
Railroad Commissioners.

WOODWARD EMERY,
CLINTON WHITE,
CHAS. C. DOTEN,
Harbor and Land Commissioners.

On Sept. 17, 1900, the joint Board passed the following votes relative to contracts between the city of New Bedford and Cole Brothers : —

Boston, Sept. 17, 1900.

At a meeting of the joint Board of Railroad Commissioners and Harbor and Land Commissioners, held this day at 20 Beacon Street, Boston, all the members being present, it was unanimously —

Voted, That the joint Board established under the provisions of chapter 439 of the Acts of 1900 hereby approves the contract and specifications for building a temporary bridge between New Bedford and Fish Island, dated Sept. 11, 1900, and executed by and between Cole Brothers and the city of New Bedford.

Boston, Sept. 17, 1900.

At a meeting of the joint Board of Railroad Commissioners and Harbor and Land Commissioners, held this day at 20 Beacon Street, Boston, all the members being present, it was unanimously —

Voted, That the joint Board established under the provisions of chapter 439 of the Acts of 1900 hereby approves the contract and specifications for removing the old bridge between New Bedford and Fish Island, dated Sept. 11, 1900, and executed by and between Cole Brothers and the city of New Bedford.

On Sept. 20, Oct. 9, 24, and Nov. 12, 1900, the joint Board gave public hearings on the matter of approval of plans and specifications.

Proceedings relative to the matter of the construction of the permanent bridge are progressing under the requirements of the statutes as rapidly as the nature of the case will permit.

CAPE COD CANAL.

The Boston, Cape Cod & New York Canal Company, chartered by chapter 448 of the Acts of 1899, to construct and operate a ship canal between Barnstable Bay and Buzzards Bay, after depositing \$200,000 with the Treasurer of the Commonwealth, filed with the Board of Harbor and Land Commissioners plans of the proposed location and construction of the canal in accordance with the requirements of its charter.

A hearing on the approval of plans was given on Nov. 28, 1899, as stated in last year's report, and was continued at the request of the representatives of the Canal Company by sundry adjournments until December 6 of this year, which was fixed by the Board as the date for final hearing. At several of the hearings remonstrants appeared and were given an opportunity to be heard. During the last session of the Legislature the Canal Company secured an amendment of its charter, being chapter 476 of the Acts of 1900.

BOAT HARBORS.

From specific appropriations made by the Legislature, the sum of \$69,073.87 has been expended on harbors of the above class. In the nature of things, an average amount of repairs will be required on works of this character which are exposed to the violence of the elements, otherwise they will fail to subserve the uses for which they were originally intended. In some exposed situations, where the conditions are changing, as in shifting sands, the expense would naturally be greater than in others.

The Board reasserts its views, as expressed in last year's report, that these harbors are as yet more or less experimental, and that new works of this nature should be determined with caution, for, beyond the original outlay, nothing but lapse of time will give data from which an estimate of the annual cost of repairs could be fairly made.

CUTTYHUNK HARBOR.

By chapter 33 of the Resolves of 1900 the Board was directed to make a survey and estimate as to the advisability and cost of improving the harbor of Cuttyhunk in the town of Gosnold.

The island of Cuttyhunk is the most easterly of the chain of islands known as the Elizabeth Islands, which constitute the town of Gosnold. The outer harbor is a body of water lying between the islands of Cuttyhunk and Nashawena. The south side of the harbor is bounded by a long, narrow beach, the outer side of which abuts on Vineyard sound and extends from the main portion of the island of Cuttyhunk nearly to Nashawena, being separated from that island by a narrow strait, known as Canapitsit Channel, which has a depth of about 7 feet at mean low tide. On the north side the harbor is protected by Penikese and Gull islands. The water between Cuttyhunk and these islands is obstructed by rocks and shoals, through which, however, a narrow and somewhat crooked channel runs, having a depth of about 23 feet at mean low tide. The main entrance to Cuttyhunk outer harbor is from the north-east, between Nashawena and Gull islands. It has a wide, deep entrance, and is well protected except from the north-east, in which direction it is too open and exposed to give proper shelter to small yachts and fishing boats. The only way to make a landing from a vessel is by means of small boats drawing not more than 3 or 4 feet of water. The landing place is inside a large bay or inner harbor, having an area of 108 acres, and is separated from the outer harbor by a sandy beach. The only entrance is by a narrow, shifting channel through the sand flats, over a bar with a depth of about 3 feet at mean low water. This bay forms the only safe harbor for the sail boats which are used for fishing or pleasure in this vicinity. The mean range of tide is 3.6 feet.

After inspecting the locality and making inquiries among the inhabitants, it was decided to confine the survey to the bay or inner harbor and its approaches, and to limit the plans

of improvement to such works as would enable the United States mail steamer to make a landing at the island without the use of small boats, or to make a new entrance which would be readily accessible to sail boats and light draught yachts, similar to the one made in 1899 at Lake Anthony in the town of Cottage City. Three projects have been evolved, as shown on plan appended:—

First.—To enlarge the present area of deep water at the boat landing just inside the entrance to the bay, and thence to excavate a channel 150 feet wide, with side slopes of 5 to 1, extending to deep water in the outer harbor, all to be dredged to the depth of 10 feet at mean low water. In order to protect this channel, two jetties would have to be built, one on the north side, extending from a point on the beach on the eastern side of the bay, and the other from a point on the beach on the south side of the harbor about 1,400 feet east of the present boat landing, the outer ends of both jetties to extend to a depth of 12 feet at mean low water, where they should be 300 feet apart.

Second.—To make an opening through “the neck beach” on the north-western side of the pond, 150 feet wide on the bottom and 10 feet deep, the channel to extend from a depth of 10 feet on the outside of the beach, through the beach, up to the old wharf at the end of the point below the village, with a basin 300 feet square in front of the wharf, all to be 10 feet deep at mean low water; the entrance channel from the outside to be protected by two stone jetties extending from the beach out to a depth of 12 feet at mean low water. If this project were carried out, the tide setting through Buzzards Bay and Vineyard Sound would presumably draw through the inner harbor, keeping open the new entrance as well as the present one, and would probably scour out more or less of the loose sand now in the harbor.

Third.—To make a smaller entrance for the accommodation only of the class of boats now frequenting the pond, but giving them a safe entrance at nearly all times. This plan would be to dredge a channel 4 feet deep at mean low water, 100 feet wide through the beach at the north-east end of the

pond, and to dredge a small amount of material from the bar in the pond. The entrance of the channel to be protected by stone jetties extending from the beach out to a depth of 6 feet at mean low water. In connection with this plan, for the purposes of enabling steamers to make a landing on the island, a wharf might be built from the beach on the south side of the main harbor near the life-saving station, extending from the shore out to a depth of 10 feet at mean low water. This third project would be cheapest. The estimated cost of the different projects is as follows:—

1. Old entrance, 10 feet deep, 150 feet wide:—			
113,000 cubic yards dredging, at 30 cents, . . .			\$33,900
36,000 tons stone, at \$2.00,			72,000
10 per cent.,			10,600
			<hr/>
			\$116,500
2. Neck beach, 10 feet deep, 150 feet wide:—			
90,000 cubic yards dredging, at 30 cents, . . .			\$27,000
20,000 tons stone, at \$2.00,			40,000
10 per cent.,			6,700
			<hr/>
			\$73,700
3. Boat entrance, 4 feet deep, 100 feet wide:—			
20,000 cubic yards dredging, at 50 cents, . . .			\$10,000
7,500 tons stone, at \$2.25,			16,875
10 per cent.,			2,675
			<hr/>
			\$29,550

The population of Cuttyhunk is 100; the number of voters is 29 and the valuation is \$36,812; 22 boats are owned on the island, and make a harbor in Cuttyhunk Pond. The commerce arriving and leaving Cuttyhunk during the years 1892 to 1897 was estimated by the United States engineers, as follows:—

1892, 700 tons.	1895, 1,871 tons.
1893, 708 tons.	1896, 2,921 tons.
1894, 1,633 tons.	1897, 3,128 tons.

The cheapest of the foregoing projects involves a considerable expenditure of money, and the Board would not

feel justified in recommending its advisability before efforts to induce the federal government to undertake the enterprise had been exhausted. The project naturally falls within the scope of the river and harbor improvements authorized by Congress.

WAQUOIT BAY.

By chapter 42 of the Resolves of 1900 the Board was directed to make a survey and estimate as to the advisability and cost of improving the entrance to Waquoit Bay in the town of Falmouth.

Waquoit Bay is located in the south-eastern portion of the town of Falmouth. The main portion of the bay has an area of 877 acres; smaller connecting bays give an additional area of 644 acres. The bay discharges at its southern end into Nantucket Sound by means of a narrow opening about 250 feet wide. The main portion of the channel through this entrance has a depth of over 6 feet at mean low water. There are bars, however, both inside and outside, having a depth of between 3 and 4 feet only at low water. The channel is also crooked and difficult to enter from the sound, except in smooth weather. The mean range of the tide is about 1.4 feet.

It is said by the inhabitants in the neighborhood that the entrance channel was formerly deeper and less obstructed than at present. Considerable change has occurred in the vicinity of the entrance since 1846, the date of the survey by the Coast Survey, although the general location of the main channel has not materially altered. In 1846 the channel over the bar was to the eastward of the entrance, while at the present time it is to the westward. It is said to shift considerably in heavy storms.

A survey was made of the entrance channel and the beach separating the pond from the sound in July and August, and three different projects are outlined for improving the entrance, with estimates of the cost of each.

From an examination of the plan made by the Coast Survey in 1888 and the surveys of this Board, it is found that a depth of 5 feet at mean low water through the entrance

channel would be as great as would be warranted by the depth of water in the main portion of the bay, and all three channels have been planned with the depth of 5 feet at low water and side slopes at an angle of 5 to 1.

The first project for improving the present entrance would be the building of stone jetties on either side, to direct the current and prevent the waves from driving the sand along the beach into the channel. The projected channel would be 200 feet wide and straight from the sound into the deep water of the bay, and as nearly as possible on the line of the existing channel; a modification of this might be made at the inner end by stopping the channel on the southerly side of the inner bar and following the existing channel to the westward. This will decrease the amount of excavation and the cost.

The second project would be the cutting of a channel through the beach to the westward of the present entrance, where the deep water approaches nearest to the shore. It would have the same width and depth as the first channel, and the jetties would extend out to a depth of 8 feet at mean low water. This location is objectionable, because its axis trends from the north-east to the south-west, and it would be difficult for boats to "beat out" in south-westerly winds, which prevail during the summer season.

The third project would be a channel through the beach to the east of the present entrance, and is substantially the same as the second plan, except that the axis trends from the north-west to the south-east, which would give a fair wind, passing in and out with the prevailing summer winds. The waters of the bay around the inner end of this channel are filled with weeds, but a clear channel could be dredged through them in constructing the entrance. The deep water of the sound does not come in as near the shore opposite this entrance as opposite the entrance of the second project, and the entrance is from a quarter to half a mile farther from the wharves at Falmouth and Menauhant.

Estimates of the cost of the three projects are as follows: —

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No. 1:—

84,000 cubic yards excavation, at 45 cents, . . .	\$37,800
17,000 tons stone, at \$2.50,	42,500
10 per cent.,	8,000
	<hr/>
	\$88,300

If the inner end of the channel should turn to the east and follow the present channel, the above cost could be reduced as follows:—

12,300 cubic yards excavation, at 45 cents, .	\$5,535	
10 per cent.,	553	
	<hr/>	6,088
		<hr/>
		\$82,212

No. 2:—

77,500 cubic yards excavation, at 45 cents, . . .	\$34,875
14,000 tons stone, at \$2.25,	31,500
10 per cent.,	6,625
	<hr/>
	\$73,000

No. 3:—

64,000 cubic yards excavation, at 45 cents, . . .	\$28,800
12,000 tons stone, at \$2.25,	27,000
10 per cent.,	5,580
	<hr/>
	\$61,380

We are informed that the number of vessels at present making a harbor in the bay are 1 schooner, 1 sloop and 10 or more cat boats; that, owing to the deterioration of the entrance channel, many goods which formerly were brought to Waquoit by small schooners are now brought by teams from Falmouth; that 300,000 feet of lumber were rafted ashore here from vessels lying in the sound during the past year; and that it is the opinion of well-informed people that the construction of any one of the proposed channels would result in an increase in the use of the bay.

Doubtless any improvement of the channels at the entrance of Waquoit Bay would be appreciated by those having occasion to use them. The cost, however, of any project contemplating a permanent benefit would seem to be disproportionate to any possible benefit at the present time. The country around the bay is sparsely settled, and there are as

yet no railroad connections within six miles. While the locality is attractive and in time will invite collective settlements of the summer visitor, it would be premature to advise an immediate expenditure such as either of the foregoing projects would involve. The public advantage could hardly be deemed commensurate with the cost.

LEWIS BAY.

In 1899 a survey and examination were made of Lewis Bay in the towns of Barnstable and Yarmouth, to determine the advisability and cost of improving the same for purposes of navigation.

It was found that there were two channels entering the bay from Nantucket Sound to the depth of about 6 feet at mean low water, but that there was considerable less depth in the channel leading to the wharves in the inner bay.

Estimates were made of the cost of improving the channel, and by chapter 194 of the Acts of 1900 an appropriation of \$12,500 was made for dredging, to the depth of 6 feet at mean low water, the channel leading to the wharves in the inner bay. Plans and specifications were prepared for doing the work, and on May 17, 1900, a contract was made with Messrs. Cole Brothers of Fall River, the lowest bidders, for excavating the channel. Work was commenced in July and was finished Nov. 3, 1900. In all 30,188 cubic yards of material were excavated and deposited in Nantucket Sound on the southerly side of Point Gammon, out of the way of navigation, and \$12,251.57 was expended in doing this work, including supervision.

The completion of this work gives to Lewis Bay a channel not less than 6 feet deep and 150 feet wide in the upper and 200 feet wide in the outer portion from the sound into the wharves on the inner bay, and will be of value to yachts, fishermen and other vessels drawing not over 5 feet of water.

GREEN HARBOR.

The work on the improvement of Green Harbor, authorized by chapter 469 of the Acts of 1898, has been carried forward during the past year. The stone jetties on both

sides of the entrance to the harbor were completed in 1899. During the winter the stones of the jetties were compacted by the waves and at various points they settled, especially in the westerly jetty, which is underlaid by comparatively soft sand. After the jetties had been completed it was found that the current flowing into and out of the harbor, between the confined walls, by scouring the channel had materially increased the depth.

The timber wall, under construction at the date of the last report, was completed early in February. This wall has directed the current of Cut River, so that, instead of flowing across the harbor to oppose and interfere with the flow of the main current, it now mingles with and flows out directly through the entrance, assisting instead of retarding the main current in keeping the entrance clear.

Early in the spring plans and specifications were prepared for dredging the channel between the jetties to the depth of 5 feet at mean low water with a bottom width of 60 feet, and for excavating an anchorage basin just inside of the Narrows, so called, about 350 by 300 feet, and of the same depth as the entrance channel.

Contract for this work was awarded to Augustus B. Martin, the lowest bidder, for the sum of $28\frac{1}{2}$ cents per cubic yard, scow measurement. The work was commenced in June, and is now completed. So far as can now be said, there is little tendency, if any, to block the channel with material thrown up by the waves at the entrance. A small amount of sand may be washed or blown into the channel over the top of the westerly jetty, as the beach back of it gradually fills in; and a certain amount of material may be brought down by the ebb tide from the sand banks in the upper portion of the harbor and deposited in the anchorage basin. Dredging out the whole of the inner harbor would be necessary in order to insure against this latter contingency. In order to prevent material from washing over the top of the south jetty, the timber bulkhead built at its inner end was extended alongside the jetty with its top at an elevation of about 15 feet above mean low water out to the mean high-water line on the beach. This will act as a barrier to

catch the sand and gradually increase the height of the beach, and thus serve to keep the waves from washing over the beach into the new channel.

All the work contemplated by the act authorizing the improvement of the harbor has now been completed, though it may be necessary during the coming spring to raise the elevation of a portion of the westerly jetty where it has settled. It is thought best to delay this work as long as possible, in order to give the jetties ample time to settle.

The expense of the work is as follows:—

For land at inner end of westerly jetty,	\$250 00
Constructing stone jetties,	33,256 93
Building timber training wall and fence at outer end of stone jetty,	2,906 00
Dredging channel and anchorage basin,	26,073 79
Extending bulkhead,	152 00
Surveys and supervision,	2,282 54
Removal of bowlders at entrance of channel, . .	403 95
Total,	<hr/> \$65,325 21

The appropriation was \$67,000.

LAKE ANTHONY.

The harbor created by the construction of the channel into Lake Anthony, at Cottage City, which was completed in the fall of 1899, has been frequented by a large number of cat-boats and yachts during the past season. An examination was made during the summer, and it was found that the stone work of the jetties had settled somewhat at their inner ends near the original high-water mark of the outer beach; that the banks on the inner end of the cut, where they were not protected by the stone riprap, had been washed away; and that on the extreme inner end of the north shore a shoal had been built out, which, if not arrested, would tend to narrow the channel. For this reason it was deemed advisable to extend the riprap protection the whole length of the cut, and to place additional stone at the inner ends of the jetties where they had settled. This was done during the month of September, about 600 tons of stone being

used in the work, at a cost of about \$1,800. The expenditure was made under the provisions of chapter 309 of the Acts of 1900.

A survey made at this time showed that the channel kept its full depth and width.

Two wharves have been built in the harbor by private parties to accommodate the yachts and boats. As many as 40 to 50 boats are reported to have been anchored at one time in the new harbor. In point of utility and attractiveness it has exceeded expectations.

MENAMSHA INLET.

But little change has taken place at Menamsha Inlet. The current in scouring out the channel has caused a portion of the stone in the westerly jetty to settle, lowering the crest so that north-westerly gales drove considerable quantities of sand over into the channel. This was in turn scoured by the current and carried to the outer end of the jetties, where it was deposited.

During the winter the inhabitants in the vicinity of this harbor endeavored by such means as were at their disposal to form a new channel for the inlet from the inner end of the jetties across the sand flat up to the wharves near the Tilton House. A depression in the flat was first made by the use of horses and scrapers for a channel, and a dike of stakes, plank and brush was built across the existing channel on the easterly side of the new cut, with the expectation that the current would be deflected by this, and would scour out a channel in the location of the cut. The dike as constructed did not have strength enough to resist the current of the spring tide, which occurred soon after it was built. The attempt to change the channel was then abandoned.

Soon after the completion of the jetties at the inlet in 1899 the flood tide setting across the sand flats opposite the inner end of the jetties washed large quantities of loose sand up toward Menamsha Pond and deposited it in the channel of the inlet about opposite the Tilton House. This material contracted the area of deep water where the packets which ply between this inlet and New Bedford were accustomed to

lie. Afterwards a quantity of this sand washed down the stream, and the area of deep water at this point again became enlarged.

In order to prevent the sea from washing the sand from the beach over the westerly jetty into the channel, a short section of timber bulkhead was built across the beach to act as a sand-catch, and at the same time about 300 tons of stone were placed on this jetty, building it up to somewhat above the original elevation. Since this was done it has been reported by people living in the vicinity that the depth in the channel has increased, and that only a comparatively small amount of sand has been driven over the jetty in the heavy storms which have occurred this fall.

The cost of the timber bulkhead is \$78.95. The stone work was included in the general contract for work at Menamsha, Lake Anthony and Osterville, at a cost which may be fairly estimated at \$900. It was expended under the provisions of chapter 309 of the Acts of 1900.

OSTERVILLE.

At the date of the last report the work on the channel had been discontinued. Work was resumed early in the season, when it was found that a shoal had formed in the channel a short distance inside the inner end of the jetties. The excavation of the channel was fully completed, including the removal of this shoal, early in July. It has been used by yachts and boats throughout the season.

During the winter a portion of the easterly jetty was pressed over into the channel a few inches. The Board then decided to begin the work of reinforcing the timber jetties with stone during the present season. Accordingly a contract was made, in connection with other work, for placing about 300 tons of stone on the easterly side of the east jetty, and thus protect the timber work from the heavy southeasterly gales. This work was done during the latter part of September, at a cost of about \$900, under the provisions of chapter 309 of the Acts of 1900.

Owing to the large areas of sand flats and the cross currents in the bay, especially that from Sepuit River, there is

liability of a certain amount of shoaling and change in the dredged channel. Some of the shoals may have to be removed by dredging from time to time, until the currents have accommodated themselves to the changed conditions.

WITCHMERE HARBOR.

As stated in the last report, the work under the modified plan for improving the harbor had not been completed, owing to the late date at which it was begun. Early in the spring the balance of the stone for the westerly jetty was placed in position, making 918 tons in all. The total expense of this improvement, including both stone and timber jetties and supervision, amounted to \$4,698.33 as follows:—

Timber jetty,	\$1,842 00
Stone jetty,	2,754 00
Supervision,	102 33
Total,	<u>\$4,698 33</u>

On visiting the work in the spring it was found that the portion of the jetties already completed had prevented the seaweed from being carried up into the harbor, and the shoal at the inner end of the entrance channel had settled so that during the summer very little complaint was heard of any odor escaping from it. The navigable channel at the entrance gradually deepened. The amount of seaweed which is annually driven ashore on the beach in this vicinity is large, and since the construction of the jetties quantities have been piled up on the beach just west of the entrance to the harbor. This beach is used by a number of summer visitors as a bathing place, and complaint has been made to the selectmen and through them to the commissioners that the piling up of the seaweed was very detrimental to its use for that purpose. An inspection of the locality was made by the Board, and the people interviewed. It seems that the seaweed driven on the beach is an obstruction to its free use as a bathing place, but if it is allowed to be driven up into the harbor it settles and becomes a nuisance which in the opinion of the summer residents is injurious to health, and also becomes an obstruction to the use of the harbor by boats.

PLEASANT BAY.

On July 31, 1900, a petition was presented to the Board, asking for a survey of Pleasant Bay and its vicinity, such as would give sufficient data for an opinion as to what action, if any, could be taken to render the bay and its entrance a safe harbor.

An inspection of this locality was made Aug. 17, 1900, and was sufficient to satisfy the Board that the expense of making a new harbor through the shifting sands off Nauset Beach would be very much beyond the scope of any recommendations heretofore made for a similar purpose. The subject matter is fully covered by a resolution of the Legislature to Congress, adopted March 15, 1900, in favor of establishing a harbor of refuge at this place.

A survey of the locality would necessarily cover an extended area, and involve large expense. For the above reasons, no further action was taken.

FALL RIVER HARBOR.

At Fall River, in November, 1899, a public hearing was given by Maj. D. W. Lockwood, Corps of Engineers, U. S. A., on the subject of a proposed harbor line for the harbor of Fall River, extending from the Providence Railroad bridge north of Fall River south to the State line between Massachusetts and Rhode Island. A member of the Board attended the hearing. A line was established by the Secretary of War, and a plan of the same has been requested for filing in this office.

The growth in business and commerce at Fall River rendered the establishment of a harbor line a matter of importance.

CONNECTICUT RIVER.

Pursuant to the policy established by chapter 344 of the Acts of 1885 and of sundry subsequent resolves, the Legislature, by chapter 100 of the Resolves of 1900, authorized the Board to expend "the sum of fifteen thousand dollars, for such surveys and examinations and for such protective works as may be found necessary and practicable to protect

the easterly bank of the Connecticut river in the town of Hadley and the highway near said bank from further encroachments of said river."

Accordingly, after proper investigation, it was decided to continue the protective works up the river from the point where operations were suspended in 1899 near the head of Middle Street in Hadley. The work then done has satisfactorily stood the test of time, and preserved the bank of the river in that place from further erosion.

Mr. E. C. Davis of Northampton, who had superintended the prior works of that nature on the river, was employed. The same general plan in building the protective works was followed as heretofore. First the banks were graded to a uniform slope of 2 to 1; the slope of the bank was then covered from a height of 2 to 3 feet above high-water mark down to the foot of the slope or deepest part of the river with mats made of poles and brush, interwoven, wired and spiked together, and held in place by a covering or riprap of rough stone. An improved method of constructing the submerged part of the mat was adopted, and that was by making it a continuous piece of work, without breaks, instead of weaving and sinking it in sections, as was formerly done. This has led to greater expedition and a reduction in cost of the work.

Active operations were commenced August 28, and the work was completed for the season November 24. It extends from the head of the work of 1889 up the river 1,269 feet to a point nearly opposite the old Amherst road, leading past the Hadley Almshouse, and covers an area of 16,127 square yards, at a cost of 69.7 cents a yard.

The laborers employed upon the work, so far as they could be obtained, were residents and tax payers of the town of Hadley.

In order to complete the protective works upon this reach of the river, it would be necessary to extend the same about as far again up the river to a point near the mouth of Coleman's Brook.

The report * of the engineer in charge may be found in the Appendix.

* See Appendix D.

GREAT PONDS.

The Board is given jurisdiction over great ponds by chapter 318 of the Acts of 1888. Each year brings up questions of varying importance to be determined.

In December a complaint was received relative to encroachments upon Lake Quannapowitt in Wakefield.

In January a question arose at the hearing on the petition of the Fells Ice Company to build structures and make excavations in Crystal Lake in the town of Wakefield, involving the right of this Board to interfere with a dam, erected under the provisions of chapter 335 of the Acts of 1872, and before the enactment of chapter 318 of the Acts of 1888, which raised the level of the pond above the natural high-water mark. The Board declined to take jurisdiction.

In March complaint was made that certain parties were drawing down the waters of Maquan Pond by lowering the outlet. This is one of those ponds the shores of which are being settled by summer residents, who are interested in keeping up the waters of the pond during the summer months. The object of lowering the pond was for the purpose of flowing a cranberry bog. An examination of the premises and an inquiry as to the facts being made, the matter was adjusted.

In May an application was made for a lease of an island in West Washacum Pond in Sterling. It was not granted.

In August an inquiry was made by the town of Lincoln as to its obligation to take a license from this Board for the purpose of encroaching upon Sandy Pond, notwithstanding it had taken the pond as a source of water supply under chapter 188 of the Acts of 1872. The Board took the opinion of the Attorney-General, which appears in the following correspondence:—

Aug. 3, 1900.

HON. HOSEA KNOWLTON, *Attorney-General, State House, Boston.*

SIR:—The town of Lincoln desires to make some changes in the arrangement of its pumping station on the shore of Sandy Pond in Lincoln, and incidentally to straighten or otherwise improve the shore line, and has applied to this Board for direction in the matter.

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Sandy Pond is a source of water supply for Lincoln, under chapter 188 of the Acts of 1872, — see especially section 11.

The Board wishes to be informed as to whether the passage of that act has superseded the authority of the Board over great ponds, given by chapter 318 of the Acts of 1888, to such an extent that the town of Lincoln may erect structures in the pond and change the outline of the shores, by virtue of its legislative grant, without asking this Board for approval of its plans.

A copy of their application is annexed.

Yours truly,

WOODWARD EMERY,
Chairman.

BOSTON, NOV. 27, 1900.

WOODWARD EMERY, Esq., *Chairman, Board of Harbor and Land Commissioners.*

DEAR SIR:— Your letter of August 3 states that the town of Lincoln desires to make certain changes in the arrangement of its pumping station on the shores of Sandy Pond in Lincoln and to straighten out and otherwise improve the shore line, and requires the opinion of the Attorney-General whether the approval of your Board is necessary therefor.

By St. 1888, c. 318, great ponds were put under the control of the Harbor and Land Commissioners; and it was provided in section 2 that "except as authorized by the general court and provided in this act, no structure shall hereafter be built or extended, or piles driven, or land filled, or other obstruction or encroachment made, in, over or upon the waters of the same."

Section 3 further provides as follows: "All persons that are or may be authorized by the general court to build or extend any structure or do any other work aforesaid, and who have not begun the same, shall, before beginning it, give written notice and submit plans of the work they intend to do to the board of harbor and land commissioners; and the provisions of section eight of chapter nineteen of the Public Statutes shall apply to all such works and to the plans therefor, and to the approval thereof by said board."

The statute under which the town of Lincoln is authorized to erect structures upon and make changes in the shore of Sandy Pond was enacted in 1872, many years before the statute above quoted giving jurisdiction to your Board over great ponds; but it is to be observed that the provisions of section 3 of the great pond act, above quoted, include not only structures to be hereafter authorized by the General Court, but also those which had

authorized by some provision of the Legislature before the

enactment of the statute. This is clearly within the power of the Legislature. The statute of 1872, in giving to the town the power to take land for a public use, did not give it an absolute right the exercise of which the Legislature could not afterwards supervise. Nor is the statute of 1872 a contract with the town. The statute of 1888, therefore, does not take any property right from the town or impair the obligation of a contract. The town of Lincoln must, therefore, submit its plans to your Board for approval, unless there is some provision of the statute which exempts it therefrom.

The act of 1872, relating to Sandy Pond, provides in section 2 as follows: "Said town, for the purposes aforesaid, may take and hold the waters of Sandy Pond, so called, in the town of Lincoln, and the waters which flow into and from the same, and may also take and hold, by purchase or otherwise, all necessary lands for raising, flowing, holding, diverting, conducting, purifying and preserving such waters, and may erect thereon proper dams, reservoirs, buildings, fixtures and other structures, and make excavations and embankments, and procure and run machinery therefor."

This section gives to the town the exclusive and unlimited right to use the waters of Sandy Pond for the purposes of a water supply, but it does not otherwise take away the rights of the public in the pond. It still remains a public pond, open to the public for all purposes for which it may lawfully use the great ponds of the Commonwealth, subject only to the right of the town to draw off the water for the purposes of a water supply. (*Rockport v. Webster*, 174 Mass. 385.)

The public, therefore, is still interested in the pond, and the purpose of requiring the approval of your Board for structures upon and changes in great ponds is the protection of the public rights in such ponds. The case does not differ from that presented by the statute authorizing the construction of the terminal station over tide water, in which I advised your Board that all plans therefor must be approved by the Board. (1 Opinions Attorney-General, 480.)

I am of opinion, therefore, that the approval of the Board is necessary for the work proposed by the town of Lincoln.

Very truly yours,

HOSEA M. KNOWLTON,
Attorney-General.

Under the act for the protection of great ponds the Board is given jurisdiction to prevent encroachment below high-

water mark. The occupation of the shores of great ponds by summer residents, and subsequent artificial changes incident thereto on the shores and banks, have a tendency to obliterate the natural high-water mark.

For the purpose of ascertaining with certainty the jurisdiction of the Board and of determining the true limits of sound discretion with reference to this class of questions, it is desirable that surveys should be made and bench marks or water levels established. This work may be gradually performed to the best advantage and at comparatively small expense by the appropriation of a small sum each year, to be expended by the Board in making surveys and taking levels of such ponds as are brought to its attention in the manner hereinbefore described, whereof a record would be placed on file for future use.

BACK BAY LANDS.

Some portions of the Back Bay district sold by the Commonwealth for residential purposes are undergoing changed conditions, owing to the encroachments of trade.

The deeds of the Commonwealth contain stipulations against at any time using the premises conveyed for stable, mercantile or manufacturing purposes. In consequence of these changed conditions in certain neighborhoods, application has been made to the Board to interpret these restrictions, with a view to applying the interpretation to the premises concerned. Accordingly the opinion of the Attorney-General was asked, and his answer, which contains a statement of the question involved, is as follows:—

*Board of Harbor and Land Commissioners, WOODWARD EMERY, Esq.,
Chairman.*

DEAR SIR:—I have your letter of the 26th, submitting to this office certain questions with regard to the construction of the stipulations in the deeds of the Commonwealth that buildings erected upon the Back Bay “shall not, in any event, be used for a stable, or for any mechanical or manufacturing purposes.”

It is stated in your letter that the specific inquiry arises from a request by certain property owners who desire to learn “whether they may lease their houses and premises without violating the aforesaid, for any of the following purposes: first,

for decorating of pottery, with a furnace in the cellar for baking it; second, for a boarding-house, on condition of placing a small power engine for elevators and steam laundry apparatus, with the privilege of extending the business of the laundry; third, as a tailoring establishment, with a small power engine for elevators to run the sewing machines on all the floors."

I am of the opinion that any use of the estates in question for other than residential purposes would be a violation of the stipulations in the deed. Such a use of the premises does not exclude the use of engines, boilers and machinery, so far as they may properly be employed in connection with the use of the house as a residence; otherwise, if for purposes of trade or business.

If the proposed uses, as above quoted, are for the carrying on of a business, and not incidental merely to the use of the house as a residence, they come within the spirit of the stipulation and are barred by its terms.

Very truly yours,

HOSEA M. KNOWLTON,
Attorney-General.

PROVINCE LANDS.

As was contemplated at the time of the passage of the act, about one-third of the appropriation made by chapter 145 of the Acts of 1899 has been expended during the past year on the Province Lands, amounting to \$2,890.82. Of this amount, \$757.50 was expended in the extension of the new road from Grand View Hill 2,300 feet toward the life-saving station at the coast. The cost thereof averages about 33 cents a running foot.

It is estimated that an expenditure of less than \$700 next year will complete the road to the outer beach, a distance of about 1,900 feet.

The territory planted keeps in place, unmoved by the fiercest winds. The transplanted beach grass takes root and is spreading in a satisfactory manner. The trees and shrubs are growing as rapidly as under the circumstances could be expected.

There can be no longer any question as to the solution of the problem undertaken by the Board six years ago of determining the right method of preventing the sands from blowing in upon the forest and strangling the vegetation between the settlement and the back side of the Cape.

Over the section of the low lands lying between the several ranges of sand dunes a good deal of the planting has been from the seed of the Scotch pine, the Austrian pine and the native pitch pine, and so far has yielded very satisfactory results. About 14,000 of these three kinds of pines, grown in the nursery, have been transplanted in and among the grasses; also about 1,000 shrubs of Scotch broom, and in addition to the foregoing a large quantity of bayberry taken from the adjacent low lands. This transplanting has been done chiefly along the foot of the sand dunes.

Owing to the continued drought of last summer, which shortened the season for transplanting beach grass, only about 25 acres were covered.

The Board has permitted those persons who have been in the habit of mowing certain parcels of the Province Lands and also of picking cranberries therefrom to gather these crops, on payment of a small license fee, without, however, granting them any rights or privileges in the soil. Otherwise, these crops would go to decay and waste. In order to avail themselves of this privilege, it is necessary for any one so wishing to call upon the resident agent and make arrangements with him and pay him the license fee, preference always being given to those parties who theretofore had been accustomed to enjoy the products of the particular parcel for which they respectively requested a license. In this way, while the ownership of the Commonwealth is asserted, opportunity is afforded these people for utilizing the crops.

The sum of \$65.41 has been collected during the season and turned over to the Treasurer of the Commonwealth.

There remains to be expended during the coming year, out of the appropriation of 1899, the sum of \$3,713.53.

The report of the Superintendent of the Province Lands * may be found in the Appendix.

* See Appendix E.

WRECKS.

Under chapter 260 of the Acts of 1883, the Board is authorized to remove wrecks and other obstructions from tide waters. The work done during the year is as follows:—

The wrecked schooner “Wide Awake” was removed from Salem harbor, under contract with Michael H. Flynn, dated Dec. 28, 1899, at a cost of \$285.

The wrecked schooner “Anna D. Price” was removed from Beverly Creek, under contract with Forman A. Crosby, dated Feb. 20, 1900, at a cost of \$100.

SURVEYS.

The amount of work done in this direction has been larger this year than previously, and the engineering force has been proportionately increased. One assistant engineer and two or three inspectors have been employed throughout the summer on the work on the Commonwealth’s flats at South Boston; and the dredging and surveys in Charles River, Green Harbor, Hyannis, Waquoit and Cuttyhunk have required eight assistants and inspectors, while two assistants have been employed in the office and two laborers on the dump at South Boston.

In addition to the measurements required to determine the amount of tide water displaced by the many different structures authorized by license of the Board, and various surveys in connection with the South Boston flats improvement, local surveys have been made at the following places:—

Jan. 30, 31. A survey was made of the marine railways of the East Boston Dry Dock Company, to determine questions which were raised in connection with their application to the Legislature for authority to extend the railways beyond the harbor line.

March 2–5, 12–29. A survey of the shore lines of Mystic River was continued and another plane table sheet completed.

March 7–10. A survey and soundings off Fiske’s wharf and Chelsea Ferry, to locate shoals on which a steamship had grounded a few days before.

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- April 3-7. A survey of the entrance to Green Harbor, as a basis for letting contract for dredging.
- April 20 to May 9. A survey at the mouth of Charles River, as a basis for contract for dredging under special appropriation by the Legislature.
- May 11, 12. A survey of Chelsea Creek, near Marginal Street, to determine the location of the harbor line.
- May 21. A survey at Shirley Gut, to determine the extent to which the Point had encroached on the Gut during the previous two years.
- July 27 to Aug. 24. A survey of the entrance to Waquoit Bay, in Falmouth, under the provisions of chapter 42 of the Resolves of 1900.
- Aug. 27 to Oct. 5. A survey of Cuttyhunk harbor, under the provisions of chapter 33 of the Resolves of 1900.
- Oct. 8-15; Nov. 1, 3, 27, 28. A survey at the mouth of Charles River, over area dredged under contract with the Eastern Dredging Company.
- Oct. 24-26. A survey of the channel dredged in Lewis Bay, at Hyannis, under contract with Cole Brothers.
- Oct. 16-23. A survey and soundings over Bird Island flats, under the provisions of chapter 97 of the Resolves of 1900.
- Sept. 4 to Oct. 24. Borings on Bird Island flats, under the provisions of chapter 97 of the Resolves of 1900.
- March 29. A survey of entrance to Witchmere harbor, in the town of Harwich, after the completion of the jetties.
- Aug. 20-24. A survey of the beaches at Scituate and North Scituate, preparatory to the construction of sea walls, under the provisions of chapter 434 of the Acts of 1900.
- April 9-17. A survey of the channel dredged at Osterville, under contract with George H. Cavanagh.
- April 12, 13. Borings in Lewis Bay, on location of proposed channel.
- Sept. 21. A survey of the entrance to Lake Anthony, at Cottage City.

INSPECTIONS MADE BY THE BOARD DURING THE YEAR.

1899.

- Dec. 1. New Bedford and Fairhaven bridge and approaches, on Acushnet River.
14. Wharf on Mystic River, belonging to heirs of Joseph Manning, relative to proposed improvements.

1900.

- Jan. 11. Property of Simonds and Adams, on Merrimac River, in Haverhill, relative to proposed sea wall and filling.
23. Work in progress in Boston harbor.
24. Work done at Green Harbor, in Marshfield, under direction of the Board. Sea wall at Brant Rock.
- Feb. 2. Salt Pond, in Harwich, in company with the engineer of the State Board of Health.
7. Rock Island Cove, in Quincy, relative to the dumping of dredged material. Site of wharf proposed to be built by William F. Macy and J. P. Fitts, at Hough's Neck, in Quincy.
19. Boston harbor and terminals, in company with members of the Boston Merchants Association and their guests.
20. Rock Island Cove, in Quincy, on complaint that channel is being obstructed by the dumping of dredged material.
23. Work done on jetties at Green Harbor in Marshfield, under direction of the Board. Sea wall at Brant Rock.
24. New mouth of North River, in Scituate. Union bridge across North River, between Marshfield and Norwell.
- March 9. Work in progress on the Commonwealth pier at South Boston. Wharf on the Reserved Channel at South Boston, under construction for the Commonwealth, to be leased to Charles Taft Chapin.
15. Mystic River, in connection with a survey of the same, in progress, under direction of the Board.
19. Maquan Pond and outlet, in Hanson, on complaint that the outlet had been excavated and the water in the pond lowered below its natural level.
21. Commonwealth flats at East Boston, in company with legislative committee.
26. Little Good Harbor Beach, in Gloucester, on complaint that sand was being removed, to the detriment of the beach.
- April 6. Channel between the jetties at Green Harbor, in Marshfield.
6. Flats in Winthrop harbor, at Point Shirley, relative to petition for license to fill the same.
12. Lewis Bay, in Hyannis, relative to dredging to be done by the Board under chapter 194 of the Acts of 1900.

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1900.

- April 13. Channel in South Bay, at Osterville.
 23. Work in progress at Green Harbor, in Marshfield.
- May 1. The Boston & Albany Railroad bridge across Chelsea Creek, between East Boston and Chelsea, relative to proposed rebuilding. Chelsea bridge, north, on Mystic River, and location of buoy on the upper side thereof, relative to suggested change of location of said buoy.
 4. Site of proposed retaining wall on Ipswich River, in Ipswich.
 10. Commonwealth flats at South Boston, in company with legislative committee.
 11. North Scituate beach, relative to alleged unlawful removal of material. Work done in Scituate under direction of the county commissioners, by authority of chapter 414 of the Acts of 1899.
 25. South Bay, in Boston, relative to proposed filling and other work.
 28, 29. Banks of the Connecticut River, in Northampton and Hadley, in company with legislative committee.
- June 2. Scorton harbor, and channel at Osterville, relative to condition of work done under direction of the Board.
 7. Work of dredging the channel in Winthrop harbor.
 12. Work done at Menamsha Inlet, in Gay Head and Chilmark, under direction of the Board. Site of structures of the Old Colony Yacht Club, in Dorchester Bay, at Savin Hill.
 22. Commonwealth flats at South Boston, and work in progress on the Commonwealth pier.
- July 2. Dock adjoining wharf of Winchester Smith, on North River, in Salem, relative to proposed filling. Wharf property of N. O. Very, in Salem.
 6. Little Good Harbor Beach, in Gloucester, relative to removal of material therefrom. Annisquam bridge, across Lobster Cove, in Gloucester, relative to proposed rebuilding.
 11. Work done at Osterville, under the direction of the Board.
 19. Site of wharf proposed to be built by John C. Haynes, in Buzzards Bay, at Sippewissett in Falmouth.
- Aug. 1. Site of wharf proposed to be built by Elizabeth F. Bowditch, in Marion harbor.

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- Aug. 3. Wharf property of Cashman Bros., on Merrimac River, in Newburyport, relative to proposed extension.
15. Beaches in Scituate, relative to sites for sea walls and other work authorized by chapter 434 of the Acts of 1900.
17. Pleasant Bay, in Chatham; Witchmere harbor, in Harwich; Lewis Bay, in Barnstable.
18. Waquoit Bay, in Falmouth, relative to survey in progress under chapter 42 of the Resolves of 1900. Work done at Osterville, under the direction of the Board.
21. Work done at Green Harbor, in Marshfield, under the direction of the Board, and obstructions at the entrance to the harbor.
22. The banks of the Connecticut River, in Hadley, relative to protective work authorized by chapter 100 of the Resolves of 1900.
30. Commonwealth flats at South Boston, and work in progress on the Commonwealth pier.
31. { Work of removing rocks at entrance to Green Harbor,
 Sept. 1. { also channel and location of proposed bulkhead.
1. Site of proposed breakwater and wharf of Alfred C. Harrison, in Little harbor, at Woods Hole. Location of cable from Nobska Point to West Chop, on Martha's Vineyard.
10. Lake Chaubunagungamaug, in Webster, relative to proposed structure.
13. Sea wall in dock at Commercial wharf, in Boston. Dredging in Lewis Bay, at Hyannis, authorized by chapter 194 of the Acts of 1900.
- 17, 18. Extension of jetties built under the direction of the Board, at Lake Anthony, in Cottage City. Work done at Menamsha Inlet, in Gay Head and Chilmark.
18. Commercial wharf and dock, in Boston. Work in progress in Charles River, adjoining pier of Fitchburg Railroad Company, and at the United States Navy Yard.
21. Work in progress on survey of Cuttyhunk harbor, authorized by chapter 33 of the Resolves of 1900. Jetties built at Menamsha Inlet, in Gay Head and Chilmark, under direction of the Board.
22. Work done at Lake Anthony, in Cottage City, under direction of the Board.

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1900.

- Sept. 24. Shirley Gut, in Boston harbor, relative to improvement by dredging.
26. Work in progress on the Commonwealth flats at South Boston.
28. Work done by the Commonwealth on the Province Lands in Provincetown.
- Oct. 2, 3. Protective work, in progress, under the direction of the Board, at Hadley, on Connecticut River, as authorized by chapter 100 of the Resolves of 1900.
5. Sea wall under construction at the Sand Hills, in Scituate, by authority of chapter 434 of the Acts of 1900. Beach at North Scituate, relative to proposed removal of material. Work in progress on channel and bulkhead, at Green Harbor, under direction of the Board. Wharves of the estate of C. D. Hunking and Geo. H. Elliott, on Merrimac River, in Haverhill, relative to proposed extension.
11. Protective work, in progress, under the direction of the Board, at Hadley, on Connecticut River. Site of proposed sewer outlet in Connecticut River, at West Springfield.
17. Wharf of Fred McQuesten, in Boston harbor, at East Boston, relative to property lines and present structures. Work in progress on the Commonwealth flats at South Boston.
18. Protective work, in progress, under the direction of the Board, at Hadley, on Connecticut River.
19. Sea wall under construction at the Sand Hills, in Scituate. Dredging and other work at Green Harbor and Brant Rock.
23. Portion of wharf on Fort Point Channel, adjoining the northerly side of Congress Street in Boston, relative to proposed extension. Work in progress at wharf of the Edison Electric Illuminating Company of Boston, on Fort Point Channel.
27. Sea wall under construction at the Sand Hills in Scituate.
River, between Silsby's Island and the
relative to petition for authority to
dredged from the river. Wharf of
company, on Taunton River, at
to rebuilding a portion of the

1900.

- Nov. 8. Sea wall under construction at the Sand Hills, in Scituate.
15. Protective work, in progress, under the direction of the Board, at Hadley, on Connecticut River.
22. The Commonwealth flats at South Boston, in company with the Governor and members of the Executive Council.
23. Sea wall under construction at the Sand Hills, in Scituate.

LICENSES GRANTED DURING THE YEAR.

Nos.

2315. Petition of the heirs of Joseph Manning for license to build sea walls and bulkheads, and fill solid, in Mystic River in the city of Medford. Granted Dec. 21, 1899.
2316. Petition of L. D. Baker and C. C. Hanley for license to build a sea wall and fill solid in Town River in the city of Quincy. Granted Dec. 21, 1899.
2317. Petition of Elliot H. Norton for license to build a pile structure in Edgartown harbor in the town of Edgartown. Granted Dec. 21, 1899.
2318. Petition of the cities of Boston and Cambridge by the Cambridge bridge commission, for approval of general plans for building a bridge across Charles River from Cambridge Street in Boston to Main Street in Cambridge, with a draw therein, as authorized by chapter 467 of the Acts of 1898. Granted Jan. 9, 1900.
2319. Petition of the city of Boston for approval of plans for building a temporary pile bridge across Mystic River, near Malden bridge, as authorized by chapter 280 of the Acts of 1899. Granted Jan. 9, 1900.
2320. Petition of the county commissioners of Franklin County for approval of plans for building a bridge across Connecticut River in the town of Northfield, as authorized by chapter 497 of the Acts of 1897. Granted Jan. 10, 1900.
2321. Petition of the Joy Steamship Company for license to drive fender piles in Boston harbor at Union wharf in the city of Boston. Granted Jan. 24, 1900.
2322. Petition of Eugene T. Adams and James F. Ring for license to build a sea wall and fill solid in Merrimac River in the city of Haverhill. Granted Jan. 24, 1900.

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- Nos.
- 2323. Petition of Thomas A. Watson for license to build a pile wharf and launching ways, and to dredge, in Weymouth Fore River in the town of Braintree. Granted Jan. 24, 1900.
 - 2324. Petition of the West End Street Railway Company for license to fill solid in Charles River near River Street in the city of Cambridge. Granted Jan. 24, 1900.
 - 2325. Petition of the Georgetown, Rowley & Ipswich Street Railway Company for license to build a trestle in and over Little River in the town of Newbury. Granted Jan. 26, 1900.
 - 2326. Petition of Sylvanus Smith for license to extend his wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted Jan. 26, 1900.
 - 2327. Petition of Bancroft C. Davis for license to build and maintain a pile pier and float stage in Katama Bay in the town of Edgartown. Granted Jan. 26, 1900.
 - 2328. Petition of John T. Scully for license to build bulkheads and fill solid in Charles River westerly of "The Front" in the city of Cambridge. Granted Jan. 26, 1900.
 - 2329. Petition of the Boston & Maine Railroad for license to fill flats in Mystic River westerly of its eastern division in the city of Somerville. Granted Feb. 1, 1900.
 - 2330. Petition of the Edison Electric Illuminating Company of Boston for license to extend its wharf, on piles, on Fort Point Channel adjoining Atlantic Avenue in the city of Boston. Granted Feb. 6, 1900.
 - 2331. Petition of the Nonquitt Wharf Company for license to extend its wharf, on piles, in Buzzards Bay in the town of Dartmouth. Granted Feb. 8, 1900.
 - 2332. Petition of George O. Stacy for license to build a sea wall and fill solid in Gloucester harbor in the city of Gloucester. Granted Feb. 21, 1900.
 - 2333. Petition of the American Telephone and Telegraph Company of Massachusetts for license to place poles in Neponset River adjoining Neponset bridge in the city of Quincy. Granted Feb. 21, 1900.
 - 2334. Petition of the Southern Massachusetts Telephone Company for license to lay a submarine cable across Vineyard Sound from Nobska Point in Falmouth to West Chop on Martha's Vineyard. Granted Feb. 21, 1900.

Nos.

2335. Petition of James H. Gibbs and J. W. DeWolf for license to build and maintain a pile pier in Nantucket harbor at Monomoy Heights in the town of Nantucket. Granted Feb. 21, 1900.
2336. Petition of the town of Swampscott, by its sewerage committee, for license to lay and maintain a sewer pipe in Nahant Bay in the town of Swampscott. Granted March 6, 1900.
2337. Petition of the Rockport Granite Company for license to extend its wharf by building sea walls and filling solid in Massachusetts Bay, near Folly Cove, in the town of Rockport. Granted March 7, 1900.
2338. Petition of the Rockport Granite Company for license to build a stone pier or breakwater in Massachusetts Bay, near Halibut Point, in the town of Rockport. Granted March 7, 1900.
2339. Petition of William F. Macy and John P. Fitts for license to build a pile wharf in Quincy Bay, at Hough's Neck, in the city of Quincy, and to dredge a basin and channel leading to said wharf. Granted March 8, 1900.
2340. Petition of John E. Lynch for license to fill solid and build a pile pier in Boston harbor at East Boston. Granted March 13, 1900.
2341. Petition of Lizzie Whipple Pierce for license to build and maintain a wharf and float stage in Quissett harbor in the town of Falmouth. Granted March 14, 1900.
2342. Petition of George A. Metcalf for license to build a bulkhead and pile platform, fill solid and maintain filling, in Mystic River, near Malden bridge, in the city of Boston. Granted March 20, 1900.
2343. Petition of Francis B. Armington for license to build a bridge over a dock in Marblehead harbor, in the town of Marblehead. Granted March 20, 1900.
2344. Petition of the Edison Electric Illuminating Company of Boston for approval of plans for laying a cable across Fort Point Channel, from said company's wharf to the easterly abutment of Congress Street bridge, in the city of Boston, under authority of chapter 249 of the Acts of 1898. Granted March 20, 1900.
2345. Petition of the United States Steel Company for license to build a bulkhead and pile wharf, to fill solid and dredge, in Malden River in the city of Everett. Granted March 27, 1900.

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Nos.

2346. Petition of C. C. Hanley & Co. for license to build a marine railway in Town River in the city of Quincy. Granted April 12, 1900.
2347. Petition of Alfred R. Turner, Jr., for license to build and maintain a boat house and wharf, on piles, in Little Long Pond in the town of Plymouth. Granted April 12, 1900.
2348. Petition of William C. Norcross Company for license to widen and extend its wharf, on piles, in South Bay, adjoining Albany Street, in the city of Boston. Granted April 12, 1900.
2349. Petition of the Boston Electric Light Company for license to build a pile structure and lay a pipe in Boston harbor, near the Reserved Channel, at South Boston. Granted April 16, 1900.
2350. Petition of the North Scituate Beach Improvement Association for license to build a stone pier in Massachusetts Bay, near Well rock, in the town of Scituate. Granted April 16, 1900.
2351. Petition of the White Head Association for license to build a pile wharf on Weir River, in the town of Hull. Granted April 16, 1900.
2352. Petition of the town of Hingham for license to lay a sewer pipe in Hingham Bay, at Crow Point, in the town of Hingham. Granted April 16, 1900.
2353. Petition of the Lowell, Lawrence and Haverhill Street Railway Company for license to build and maintain a pier on Merrimac River, in the city of Haverhill. Granted April 16, 1900.
2354. Petition of the Boston Fire Brick and Clay Retort Manufacturing Company for license to fill solid and build two pile wharves in Boston harbor, near the Reserved Channel, at South Boston. Granted April 27, 1900.
2355. Petition of the Massachusetts Highway Commission for license to reconstruct a portion of a bridge across Pines River, within the lines of location of a portion of the Boston and Salem turnpike laid out as a State highway in the towns of Revere and Saugus. Granted April 27, 1900.
2356. Petition of the Massachusetts Highway Commission for license to reconstruct a portion of a bridge across a creek flowing between Pines River and the upland, within the lines of location of a portion of the Boston and Salem turnpike laid out as a State highway in the town of Revere. Granted April 27, 1900.

Nos.

2357. Petition of the Massachusetts Highway Commission for license to reconstruct a portion of a bridge across a creek lying between Pines River and Saugus River, within the lines of location of a portion of the Boston and Salem turnpike laid out as a State highway in the town of Saugus. Granted April 27, 1900.
2358. Petition of Bela H. Jacobs for license to build a sea wall and fill solid in Merrimac River in the city of Haverhill. Granted May 2, 1900.
2359. Petition of Charles H. Pew and John J. Pew for license to extend their wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted May 2, 1900.
2360. Petition of Thomas A. Watson for license to build bulkheads and pile wharves, to fill solid and dredge, in Weymouth Fore River and Bent's Creek in the city of Quincy. Granted May 7, 1900.
2361. Petition of the city of Boston for license to rebuild portions of the pier of Broadway bridge on Fort Point Channel. Granted May 8, 1900.
2362. Petition of Orlando E. Lewis for license to fill solid and maintain filling in Crystal Bay northerly of Washington Avenue in the town of Winthrop. Granted May 8, 1900.
2363. Petition of the Fitchburg Railroad Company for license to construct and maintain a dock and wharves at the Hoo-sac Tunnel Docks on Charles River, adjoining the United States Navy Yard at Charlestown. Granted May 10, 1900.
2365. Petition of the Boston & Albany Railroad Company for license to repair and rebuild its bridge across Broad Canal in the city of Cambridge. Granted May 15, 1900.
2366. Petition of the American Telephone and Telegraph Company for license to place a pole in Neponset River adjoining the westerly draw pier of Neponset bridge in the city of Boston. Granted May 15, 1900.
2367. Petition of the Boston & Providence Railroad Corporation for approval of plans for building the draw and pile structures in connection therewith in a bridge across Fort Point Channel in the city of Boston, as authorized by chapter 516 of the Acts of 1896. Granted May 15, 1900.
2368. Petition of Thomas E. Ruggles for license to build a bulkhead and pile wharf, and to fill solid, in Chelsea Creek adjoining Marginal Street in the city of Chelsea. Granted May 18, 1900.

Nos.

2369. Petition of the county commissioners of Plymouth County for approval of plans for reconstructing the bridge, on piles, across Scituate harbor, near the second cliff in the town of Scituate, as authorized by chapter 414 of the Acts of 1899. Granted May 18, 1900.
2370. Petition of Alfred C. Harrison for license to build and maintain a boat house and float stage in Little Harbor at Woods Hole in the town of Falmouth. Granted May 18, 1900.
2371. Petition of the town of Ipswich for license to build a sea wall and fill solid in Ipswich River in the town of Ipswich. Granted May 22, 1900.
2372. Petition of the Hamilton Association for license to build a pile wharf on Fort Point Channel near Dover Street bridge in the city of Boston. Granted May 22, 1900.
2373. Petition of the cities of Boston and Cambridge by the Cambridge bridge commission, for approval of general plans for building a bridge across Charles River, without a draw therein, from Cambridge Street in Boston to Main Street in Cambridge, under authority of chapter 467 of the Acts of 1898 and chapter 180 of the Acts of 1899. Granted May 25, 1900.
2374. Petition of the county commissioners of Plymouth County for license to reconstruct Union bridge across North River in the towns of Marshfield and Norwell. Granted June 1, 1900.
2375. Petition of the city of Boston for license to extend the draw piers of Chelsea bridge, north, on Mystic River in the cities of Boston and Chelsea. Granted June 1, 1900.
2376. Petition of Emily I. Kinney for license to build and maintain a pile pier and float stage in Buzzards Bay in the town of Wareham. Granted June 1, 1900.
2377. Petition of the Warren Brothers Company for license to build a bulkhead and fill solid in Broad Canal in the city of Cambridge. Granted June 1, 1900.
2378. Petition of the estate of J. P. Monks for license to build a bulkhead and fill solid in Boston harbor near the Reserved Channel at South Boston. Granted June 1, 1900.
2379. Petition of the Metropolitan Water Board for approval of plans for laying a water pipe in and under Chelsea Creek from East Boston to Chelsea, as authorized by chapter 488 of the Acts of 1895. Granted June 1, 1900.

- Nos.
2380. Petition of the South Bay Company for license to fill solid and maintain filling in South Bay near Dorchester Avenue in the city of Boston. Granted June 13, 1900.
2381. Petition of the Vineyard Grove Company for license to build a pile pier in Lake Anthony in the town of Cottage City. Granted June 13, 1900.
2382. Petition of the Atlantic Works for license to enlarge its dock at East Boston by building a sea wall and by dredging. Granted June 15, 1900.
2383. Petition of the Boston & Albany Railroad Company for license to rebuild its bridge, widen the draw way therein, relocate the draw piers and extend the easterly draw pier, on Chelsea Creek in the cities of Boston and Chelsea. Granted June 15, 1900.
2384. Petition of the Old Colony Yacht Club for license to construct and maintain a building, floats and run way, in Dorchester Bay at Savin Hill in the city of Boston. Granted June 15, 1900.
2385. Petition of William B. Stearns for license to build and maintain launching ways, a pile pier and floats, in Marblehead harbor in the town of Marblehead. Granted June 15, 1900.
2386. Petition of Jesse Tirrell for license to build a bulkhead, sea walls and pile platforms, and to fill solid, in Boston harbor near the Reserved Channel at South Boston. Granted June 19, 1900.
2387. Petition of James W. Rollins, Jr. for license to build and maintain a pile pier and float in Quincy Bay in the city of Quincy. Granted June 21, 1900.
2388. Petition of the East Boston Dry Dock Company for approval of plans for extending its marine railway in Boston harbor at East Boston, as authorized by chapter 308 of the Acts of 1900. Granted June 21, 1900.
2389. Petition of Jens Bertelsen and John P. Petersen for license to build a pile wharf in Boston harbor at East Boston. Granted June 25, 1900.
2390. Petition of Newton W. Wanzer for license to build and maintain a pile pier and float in Hull Bay in the town of Hull. Granted June 25, 1900.
2391. Petition of West's Beach Corporation for license to build and maintain a pile pier and float in Salem harbor in the city of Beverly. Granted June 26, 1900.

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Nos.

2392. Petition of the Colonial Yacht Club for license to build a fence in Dorchester Bay at Savin Hill in the city of Boston. Granted June 27, 1900.
2393. Petition of John J. Moore and Earle H. Gowing for license to build a bulkhead, drive piles and fill solid, in Hull Bay near Allerton station in the town of Hull. Granted June 28, 1900.
2394. Petition of the board of park commissioners of Boston for approval of plans for building pile structures in Boston harbor at North End Park in the city of Boston, under the provisions of chapter 282 of the Acts of 1893. Granted June 29, 1900.
2395. Petition of the city of Boston for license to lay and maintain a water pipe across Shirley Gut between Point Shirley and Deer Island. Granted July 2, 1900.
2396. Petition of Winchester Smith for license to build a bulkhead and fill solid in a dock on South River in the city of Salem. Granted July 3, 1900.
2397. Petition of Charles E. Cotting for license to build and maintain a pile pier and float in Manchester harbor in the town of Manchester. Granted July 5, 1900.
2398. Petition of John C. Haynes for license to build and maintain a pile pier and float in Buzzards Bay at Sippewissett in the town of Falmouth. Granted July 17, 1900.
2399. Petition of the cities of Medford and Somerville for license to build a stone-arch bridge across Mystic River on the site of the present bridge at Boston Avenue in said cities. Granted July 17, 1900.
2400. Petition of the Metropolitan Water Board for approval of plans for constructing a tunnel and laying pipes under and across the draw way in Chelsea bridge, north, on Mystic River in the cities of Boston and Chelsea, as authorized by chapter 488 of the Acts of 1895. Granted July 24, 1900.
2401. Petition of the Boston Electric Light Company for license to fill solid and maintain filling in Fort Point Channel, adjoining the north-easterly line of Summer Street extension in the city of Boston. Granted July 30, 1900.
2402. Petition of the trustees of the Boston Real Estate Trust for license to fill solid and maintain filling in Fort Point Channel, adjoining the south-westerly line of Congress Street in the city of Boston. Granted July 30, 1900.

Nos.

2403. Petition of Sol Smith Russell for license to build and maintain a pile pier and boat house in Edgartown harbor in the town of Edgartown. Granted Aug. 2, 1900.
2404. Petition of James Millar & Co. for license to build and maintain a bulkhead and place riprap outside of and adjacent thereto in their dock in Plymouth harbor in the town of Plymouth. Granted Aug. 2, 1900.
2405. Petition of the heirs of J. R. Atwood estate for license to build and maintain a bulkhead and place riprap outside of and adjacent thereto in their dock in Plymouth harbor in the town of Plymouth. Granted Aug. 2, 1900.
2406. Petition of the Brockton & Plymouth Street Railway Company for license to extend its wharf, on piles, and to dredge a channel, in Plymouth harbor in the town of Plymouth. Granted Aug. 2, 1900.
2407. Petition of Elizabeth F. Bowditch for license to build and maintain a wharf and float in Marion harbor in the town of Marion. Granted Aug. 2, 1900.
2408. Petition of the city of Cambridge, by its board of park commissioners, for license to fill solid in Charles River between Brookline Street and a point about 700 feet east of Putnam Avenue in the city of Cambridge. Granted Aug. 2, 1900.
2409. Petition of Cashman Brothers for license to build a bulkhead and fill solid in Merrimac River in the city of Newburyport. Granted Sept. 10, 1900.
2410. Petition of Daniel W. Butler for license to build a stone breakwater in Little Harbor at Woods Hole in the town of Falmouth. Granted Sept. 10, 1900.
2411. Petition of Angeline B. Knowles for license to build a stone and timber wharf in Buzzards Bay at Nonquitt in the town of Dartmouth. Granted Sept. 10, 1900.
2412. Petition of the Cuttyhunk Club for license to erect and maintain fishing stands in Buzzards Bay and Vineyard Sound on the island of Cuttyhunk. Granted Sept. 11, 1900.
2413. Petition of the East Gloucester Yacht Club for license to build and maintain a pile wharf and floats in Gloucester harbor at Rocky Neck in the city of Gloucester. Granted Sept. 12, 1900.
2414. Petition of Andrew J. Lovell and others for license to repair and rebuild their wharf, on piles, on Vineyard Sound at Menauhant in the town of Falmouth. Granted Oct. 1, 1900.

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Nos.

2415. Petition of W. Harry Brown for license to build a sea wall and fill solid in Buzzards Bay at Woods Hole in the town of Falmouth. Granted Oct. 9, 1900.
2416. Petition of Henry W. Smith for license to build a bulkhead and fill solid in Chelsea Creek adjoining Marginal Street in the city of Chelsea. Granted Oct. 9, 1900.
2417. Petition of the Boston Wharf Company for license to build a sea wall and fill solid in Fort Point Channel, southwesterly of Summer Street bridge in the city of Boston. Granted Oct. 9, 1900.
2418. Petition of the Metropolitan Coal Company for license to build a pile pier in Boston harbor on the Commonwealth flats at South Boston. Granted Oct. 9, 1900.
2419. Petition of George H. Elliott and others for license to build sea walls and fill solid in Merrimac River in the city of Haverhill. Granted Oct. 9, 1900.
2421. Petition of Richard T. Green and John C. Harrington for license to build a pile wharf on Chelsea Creek adjoining Marginal Street in the city of Chelsea. Granted Oct. 23, 1900.
2422. Petition of the trustees of the Boston Real Estate Trust for license to extend their wharf, on piles, on Fort Point Channel adjoining Congress Street in the city of Boston. Granted Oct. 24, 1900.
2423. Petition of John Duff for license to extend wharf, on piles, on Acushnet River at Fish Island in the city of New Bedford. Granted Oct. 26, 1900.
2424. Petition of Hettie L. Shuman for license to build a sea wall and fill solid in Beverly Cove in the city of Beverly. Granted Nov. 5, 1900.
2425. Petition of the Haverhill Electric Company for license to lay and maintain a cable in and across Merrimac River near Groveland bridge in the city of Haverhill and town of Groveland. Granted Nov. 13, 1900.
2426. Petition of Mellen N. Bray for license to build a wharf in Onset Bay in the town of Wareham. Granted Nov. 13, 1900.
2427. Petition of the county commissioners of Plymouth County and the selectmen of Scituate for license to reconstruct Little's bridge, on piles, on North River in the towns of Scituate and Marshfield. Granted Nov. 21, 1900.
2428. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River in the city of Boston. Granted Nov. 21, 1900.

Nos.

2429. Petition of the Boston Elevated Railway Company for license to dump snow and ice into tide waters in the cities of Boston and Cambridge. Granted Nov. 23, 1900.
2430. Petition of the city of Boston, by the superintendent of streets, for license to dump snow and ice into tide waters. Granted Nov. 23, 1900.
2431. Petition of the Northampton & Amherst Street Railway Company for approval of plans for building a bridge across Connecticut River in the city of Northampton and town of Hadley, as authorized by chapter 293 of the Acts of 1899. Granted Nov. 23, 1900.
2432. Petition of the Edison Electric Illuminating Company of Boston for license to build sea walls and fill solid in Fort Point Channel at its wharf on Atlantic Avenue in the city of Boston. Granted Nov. 23, 1900.
2433. Petition of the city of Boston for license to repair the piers of Dover Street bridge on Fort Point Channel. Granted Nov. 26, 1900.

PETITIONS DENIED.

On Dec. 7, 1899, in the matter of the petition of the trustees of the Municipal Real Estate Trust for license to build a structure in the dock adjoining property of the Fiske Wharf and Warehouse Company, in Boston, the Board declined to grant a license, for the reason that any encroachment by permitting the structure to be erected in this dock, considering its size, character and location, would be undesirable and adverse to public interests.

On Dec. 11, 1899, in the matter of the petition of Edith A. Richards for license to extend a wharf on Mystic River, Charlestown, the Board declined to accede to the request of the petitioner for permission to construct a dock 36 feet wide in the centre of this property and a pile pier on the easterly and westerly sides thereof.

On Dec. 12, 1899, Reuben Brooks, petitioner for license to build a wharf and to dredge in Squam River, in the city of Gloucester, was, at his request, given leave to withdraw.

On March 22, 1900, the George McQuesten Company, petitioner for license to fill solid in Boston harbor at its wharf in East Boston, was given leave to withdraw, because the

solid filling to be done on this property was beyond the United States bulkhead line.

On March 23, in the matter of the petition of F. T. Aiken & Co. for license to build an addition to their wharf on Acushnet River, in New Bedford, it was voted that "whereas, the granting of a license upon the petition and plans filed and for the purposes declared would by implication permit the exclusive use of Commonwealth land in front of land the title to which is at present in litigation, the petitioners are granted leave to withdraw."

On April 6, C. A. Sawyer, petitioner for license to build and maintain a structure for a restaurant and other purposes in Lake Whalom, in the town of Leominster, was given leave to withdraw.

On April 26, Wm. A. Mackie, petitioner for license to build water fences in Long Pond, in the town of Freetown, was given leave to withdraw.

On May 14, in the matter of the petition of Everett E. Litchfield for authority to remove material from North Scituate beach, the Board concluded that it would be unwise to grant the desired authority.

On May 22, W. H. Tolhurst, petitioner for license to build and maintain a pile pier in Buzzards Bay, at Monument Beach, was given leave to withdraw, as the deed of the property of the petitioner proposed to be covered or occupied by said pier prohibited the erection of any buildings or structures thereon.

On September 19, Albion P. Roberts and Katie P. Roberts, petitioners for license to build and maintain fences in tide water on the beach adjoining Broad Sound, in the town of Revere, were given leave to withdraw, the selectmen of said town being opposed to the same.

On October 16, the Bay State Dredging Company, petitioner for authority to dump dredged material at the mouth of Malden River, was given leave to withdraw.

On November 8, R. B. Rodermond, petitioner for license to fill solid in Merrimac River between Silsby's Island and the Bradford shore, and to use for said filling material dredged from said river under contract with the United States government, was given leave to withdraw, as the

proposed filling might, in times of freshet, cause an obstruction, and thereby flood and endanger structures on the river above this point.

On November 8, F. P. Gurney and E. D. Gurney, petitioners for license to fill solid in Boston harbor at their wharf in East Boston, were given leave to withdraw, as the proposed filling would be outside the United States bulkhead line, and the granting of the license would destroy existing wharf and dock facilities.

On November 13, Hallett & Son, petitioners for authority to burn certain material on the Commonwealth flats at South Boston, were given leave to withdraw.

On November 26, in the matter of the petition of the city of Boston for license to repair Mt. Washington Avenue bridge on Fort Point Channel, the Board concluded that it did not feel justified in approving plans for repairing this bridge that failed to make provision for widening the draw so as to give a clear opening of 50 feet.

MISCELLANEOUS PERMITS GRANTED DURING THE YEAR.

ISAAC BLAIR & Co., to dump snow from Dover Street bridge into tide water in the city of Boston. Granted Dec. 20, 1899.

CARRIE E. MITCHELL, to remove gravel from a beach in the town of Hull. Granted Jan. 25, 1900.

BAY STATE DREDGING COMPANY, to dredge material in Shirley Gut, Boston harbor. Granted Feb. 1, 1900.

EASTERN DREDGING COMPANY, to dredge gravel from Brewster Spit, in Boston harbor. Granted Feb. 1, 1900.

C. L. EATON, to remove stones and other material from the beach at Clifton, in the town of Marblehead. Granted Feb. 5, 1900.

JOSEPH L. BOARDMAN, to remove gravel from a portion of Salter's beach, in the town of Plymouth. Granted March 8, 1900.

FLORETTA VINING, to remove gravel from a portion of Stony beach, adjoining Hull Bay, in the town of Hull. Granted April 16, 1900.

B. W. PUTNAM, to remove gravel from a portion of the beach adjoining Hull Bay, at Bayside, in the town of Hull. Granted April 24, 1900.

EDWARD D. CONANT, to remove gravel from the beach at Great Hill, Point Allerton, in the town of Hull. Granted May 8, 1900.

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JAMES F. ROBINSON, to remove stone from the beach adjoining Beach Avenue, between W and S streets, in the town of Hull. Granted May 10, 1900.

FRANK J. HANNON, to use a portion of the Commonwealth flats at South Boston for the storage of gravel. Granted May 17, 1900.

BAY STATE DREDGING COMPANY, to dump material dredged in Plymouth harbor easterly of and adjoining Long beach, in the town of Plymouth. Granted May 22, 1900.

BAY STATE DREDGING COMPANY, to dump material dredged in Duxbury harbor, under contract with the United States government, on a portion of the beach on the easterly side of said harbor, southerly of and near Duxbury bridge. Granted June 1, 1900.

J. N. SMITH & Co., to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted June 15, 1900.

ANNA I. READ, to remove stone from a portion of the beach northerly of the northerly end of Glover Avenue in the town of Hull. Granted June 21, 1900.

TRUSTEES OF THE MAIN STREET LAND TRUST, to dredge material from their flats in Charles River, on the Cambridge side of the channel, near West Boston bridge. Granted June 26, 1900.

THE CITY OF BOSTON, to lay water pipe in E Street between Fargo and Summer streets on the Commonwealth flats at South Boston. Granted June 19, 1900.

MACK & MOORE, to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted Sept. 11, 1900.

JOHN ALLEN, to remove stone from the beach at Point Allerton in the town of Hull. Granted Oct. 2, 1900.

J. N. TURNER, to remove gravel from his beach in the town of Scituate. Granted Oct. 16, 1900.

THE BOSTON ELECTRIC LIGHT COMPANY, to lay and maintain an iron pipe in Fargo Street on the Commonwealth flats at South Boston. Granted Oct. 16, 1900.

THE CITY OF BOSTON, to publish notice, in the name of the Board, of the closing of Mystic River to the passage of vessels through the draw in Chelsea bridge, north, for the purpose of dredging out and removing siphon boxes under the draw way in said bridge. Granted Oct. 29, 1900.

BAY STATE DREDGING COMPANY, to dump material dredged in Malden River, under contract with the United States government, on land and flats in a creek in said river at Edgeworth. Granted Nov. 8, 1900.

BOSTON ASYLUM AND FARM SCHOOL FOR INDIGENT BOYS, to remove gravel from a bar at Thompson's Island, in Boston harbor. Granted Nov. 8, 1900.

T. F. BAILEY, to remove gravel from North Scituate beach. Granted Nov. 9, 1900.

EDITH ANDREW, trustee, to remove gravel from the beach at the south-easterly end of Prince's Head, a part of Peddock's Island, in Boston harbor. Granted Nov. 16, 1900.

ISAAC BLAIR & Co., to dump snow from Dover Street bridge into tide water in the city of Boston. Granted Nov. 21, 1900.

WORK OF THE UNITED STATES IN RIVERS AND HARBORS OF THE COMMONWEALTH.

The Board is indebted to Col. Charles R. Suter and Capt. Harry Taylor, Corps of Engineers, U. S. A., who are in charge of river and harbor improvements in eastern Massachusetts, and Maj. George W. Goethals, Corps of Engineers, U. S. A., who is in charge of similar work in southern Massachusetts, for the following statements which show the work accomplished in the rivers and harbors of this Commonwealth during the fiscal year ending June 30, 1900: —

STATEMENT OF COL. CHARLES R. SUTER, CORPS OF ENGINEERS, U. S. A.

BOSTON, MASS., Dec. 18, 1900.

The Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, Boston, Mass.

GENTLEMEN: — In accordance with your request of Dec. 6, 1900, I have the honor to furnish the following summary of work done by the United States during the fiscal year ending June 30, 1900, in the rivers and harbors of Massachusetts in my district.

The works of improvement under my charge on June 30, 1900, were: —

- | | |
|---|-------------------------------|
| 1. Lynn harbor. | 8. Town River. |
| 2. Boston harbor. | 9. Scituate harbor. |
| 3. Chelsea Creek. | 10. Duxbury harbor. |
| 4. Mystic River, below mouth of Island End River. | 11. Plymouth harbor. |
| 5. Mystic and Malden rivers. | 12. Provincetown harbor. |
| 6. Charles River. | 13. Chatham harbor. |
| 7. Weymouth ("Fore" and "Back") River. | 14. Examinations and surveys. |
| | 15. Wrecks. |

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Operations upon these works during the last fiscal year have been as follows:—

Lynn Harbor.

No operations were in progress.

Boston Harbor.

Works of preservation: repairs were made to the sea walls at Georges, Long and Lovells islands, and a section of the riprap at Gallops Island was rebuilt to admit of widening the main ship channel at this point.

Works of improvement: dredging was continued under the contract dated Feb. 11, 1897, with Messrs. Breymann Bros. of Toledo, O., to dredge 2,910,718 cubic yards, more or less, of material from and in completion of the proposed main ship channel, 1,000 feet wide and 27 feet deep at mean low water, under the project of Aug. 11, 1892.

During the last fiscal year 875,525.16 cubic yards of material were dredged under the contract.

Under this contract all dredging has been completed in the lower main ship channel, which at the close of the fiscal year was 27 feet deep at mean low water and 1,000 feet wide, excepting that at the "Narrows" it was obstructed by ledges uncovered by the dredging, and which contract the clear width of channel to about 800 feet.

In the upper harbor the channel was dredged 27 feet deep and 1,000 feet wide to Castle Island, and thence 500 feet wide to the anchorage between Boston and East Boston.

This channel was obstructed by ledges at State ledge which contract the available width to about 650 feet, and at the upper middle by ledges which effectually close the 500-foot channel for a greater depth than 23 feet at low water. At the date of this statement operations are in progress in removal of these latter ledges.

On March 13, 1900, a contract was entered into with Messrs. Breymann Bros. to dredge 836,082 cubic yards, more or less, of material from Broad Sound Channel, under a project to make that channel 1,200 feet wide and 30 feet deep, from President Roads to the sea.

No operations were in progress during the last fiscal year.

The full estimated amount of money necessary to complete the project of Aug. 11, 1892, has been appropriated and is available, and \$322,000 has been appropriated for the Broad Sound Channel, which amount is sufficient to cover all liabilities under the contract of March 13, 1900.

Chelsea Creek.

No operations were in progress during the fiscal year ending June 30, 1900.

Mystic River, below the Mouth of Island End River.

The project of improvement, dated Jan. 18, 1899, is to dredge a channel 25 feet deep at mean low water and 300 feet wide, to a point 3,500 feet above Chelsea bridge, at an estimated cost of \$267,547.50.

The act of March 3, 1899, appropriated \$50,000 for this improvement, and on Nov. 8, 1899, a contract was entered into with Chas. H. Souther of Boston, Mass., to dredge 200,000 cubic yards, more or less, of material. During the fiscal year ending June 30, 1900, 97,753 cubic yards were dredged under this contract.

Mystic and Malden Rivers.

The river and harbor act of March 3, 1899, appropriated \$5,000 for improving these rivers.

No work was done in Mystic River during the fiscal year. In Malden River a shoal which had formed in the improved channel was removed during September, 1899.

Charles River.

No operations were in progress during the fiscal year.

Weymouth "Fore" and "Back" Rivers.

The river and harbor act of March 3, 1899, appropriated \$10,000 for this improvement, and during the fiscal year ending June 30, 1900, 34,789 cubic yards of material were dredged from Weymouth Fore River, under a contract with Joseph E. White of Quincy, Mass. No work was done on Weymouth Back River.

Town River.

The river and harbor act of March 3, 1899, appropriated \$8,000 for improvement of this river, and during the fiscal year this sum was expended in dredging 30,007 cubic yards of material from the upper end of the channel, under a contract with Joseph E. White of Quincy, Mass.

Scituate Harbor.

The sum of \$15,000, appropriated by the act of March 3, 1899, for improvement of this harbor, was expended during the fiscal year in dredging the channel from the anchorage basin to the

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wharves; 34,814 cubic yards of material were removed, under a contract with Chas. H. Souther of Boston, Mass.

Duxbury Harbor.

On July 31, 1899, a project of improvement was submitted, proposing to dredge a channel 6 feet deep at mean low water, 60 feet wide in the straight section and 100 feet wide in the curve, from the main channel to the principal wharf of the town.

During the fiscal year \$12,000, appropriated by the act of March 3, 1899, was expended in dredging a channel 6 feet deep 40 feet wide in the straight section and 60 feet wide in the curve; 43,928 cubic yards of material were dredged in making the improvement, under a contract with Augustus B. Martin of Boston, Mass.

Plymouth Harbor.

The river and harbor act of March 3, 1899, appropriated \$10,000 for maintenance and \$75,000 for repair of storm damages to Long Beach.

The appropriation of \$10,000 for maintenance was expended during the fiscal year in redredging the dredged channel and basin. In this work 44,232 cubic yards of material were dredged, under a contract with the Hartford Dredging Company of Hartford, Conn.

It was proposed to expend the \$75,000 appropriated for repair of storm damages to Long Beach in building granite rubble stone riprap on the beach.

With this purpose in view, a contract was entered into on Aug. 18, 1899, with Bell & Co. of Boston, Mass., to deposit 45,000 tons of stone in the riprap, and it was expected that about 10,000 linear feet could be built. At the close of the fiscal year the contractors had constructed about 550 feet of the riprap. The contract with Bell & Co. was annulled in October, 1900; and at the date of this statement construction of the riprap is being carried on under an agreement with the Rockport Granite Company of Rockport, Mass.

Provincetown Harbor.

During the fiscal year 1,409 linear feet of bulkhead were added to the protective works at Wood End and 400 feet of old bulkhead were repaired.

At Abel Hill 108 feet of new bulkhead were built and 105 feet of old bulkhead were repaired.

Chatham Harbor.

The river and harbor act of March 3, 1899, appropriated \$3,732.79 to complete the improvement of this harbor.

On July 14, 1899, a contract was entered into with Alonzo E. Smith of New York City, for dredging. This contract was annulled in May, 1900, because of unsatisfactory progress.

At the date of this statement a contract is in force with R. B. Rodermond of New York City, for dredging in Chatham harbor, but no work has been done under this contract.

Examinations and Surveys.

On July 28, 1899, a report was submitted on preliminary examination of Winthrop harbor, Mass., to the effect that the harbor was not worthy of improvement to the extent proposed by the river and harbor act of March 3, 1899.

On Aug. 5, 1899, a report was submitted, on preliminary examination of Sandwich harbor, Mass., to the effect that the harbor was not at that time worthy of improvement. This decision was based on a letter from the chairman of the board of selectmen of Sandwich, who suggested that consideration of the matter be postponed until the prospects of the Cape Cod Canal became more definite.

On Dec. 16, 1899, a report was submitted on the survey of Cohasset harbor, recommending the dredging of a channel from the roadstead to the town wharves, 4 feet deep at mean low water, 60 feet wide on straight sections and 75 feet wide on curves, with a turning basin 350 feet by 350 feet in area, opposite the wharves. The estimated cost of this improvement is \$21,670.

Wrecks.

Under provisions of sections 19 and 20 of the river and harbor act of March 3, 1899, wreckage of a vessel was removed from Chatham new harbor during July, 1899, at a cost of \$142.89; and during September, 1899, the wreck of the schooner boat "Lydia Jane" was removed from Provincetown harbor, at a cost of \$131.09.

Very respectfully, your obedient servant,

CHAS. R. SUTER,

Colonel, Corps of Engineers, U. S. A.

238594

STATEMENT OF MAJ. GEO. W. GOETHALS, CORPS OF ENGINEERS,
U. S. A.

NEWPORT, R. I., Dec. 17, 1900.

Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, State House, Boston, Mass.

GENTLEMEN:—In reply to letter from the chairman of the Board of Harbor and Land Commissioners of Massachusetts, I inclose herewith a statement of work of river and harbor improvement done by the federal government in this district for the fiscal year ending June 30, 1900.

Very respectfully,

GEO. W. GOETHALS,
Major, Corps of Engineers, U. S. A.

Abstract of work of river and harbor improvement in the State of Massachusetts by the United States government, under the direction of Maj. Geo. W. Goethals, Corps of Engineers, U. S. A., for the fiscal year ending June 30, 1900:—

Hyannis Harbor.

No operations have been in progress during the past fiscal year other than making a survey of the locality with a view to revising the estimate for completing the approved project. This project contemplates the dredging of an area of 36 acres, protected by the breakwater to a depth of 15.5 feet. Of this area, about 26.6 acres have been dredged, and two cuts, each 25 feet wide and 13 feet deep, have been dredged in to the wharf of the New York, New Haven & Hartford Railroad Company.

Nantucket Harbor.

Work under the contract for continuing the construction of the jetties was completed May 19. The submerged portions of the jetties were raised to the half-tide level, and about 600 feet of the outer end of the west jetty to the full height of 5 feet above mean low water.

There is now a depth of 8 feet in the channel, which before improvement was limited to 6 feet.

Vineyard Haven Harbor.

No works of improvement were in progress during the past fiscal year. The river and harbor act of March 3, 1899, provided for an examination of "Vineyard Haven, Mass., with a view to its further protection and improvement as a harbor of refuge, by breakwaters or otherwise."

The report of this examination was submitted under date of Sept. 13, 1899. In this report it is recommended that "Congress be asked to authorize a general investigation of the question of a harbor of refuge for Vineyard and Nantucket sounds, with a view to determining the best location for such a harbor."

Woods Hole Channel.

Work under the contract for removing boulders and dredging in the channel through the Woods Hole Strait was commenced Nov. 1, 1899, and completed April 7, 1900.

This work removed all obstructing shoals to a depth of 13 feet at mean low water in the southern half of the channel, between its eastern end and the southern branch, known as "Broadway," the greater portion of the shoal at the junction of the two branches of the channel, and a shoal in mid-channel just west of the junction.

The project for this improvement contemplates a channel 300 feet wide and 13 feet deep at mean low water.

New Bedford Harbor.

Work under the contract for dredging the channel from the anchorage area in the harbor through the new drawbridge between Fish and Pope's islands was commenced July 31, 1899, and completed May 15, 1900.

Work under the contract for dredging in the anchorage area was commenced Sept. 18, 1899, and completed Jan. 20, 1900. The work under these two contracts completed a channel 250 feet wide and 18 feet deep from the main channel leading to Buzzards Bay to the deep water north of the new bridge between New Bedford and Fairhaven.

A survey was made of a portion of the harbor adjacent to the New Bedford wharves above and below the old drawbridge, with a view to securing data upon which to base an estimate of further improvement.

Taunton River.

Work under the contract for dredging in this river in the reach just above Berkley bridge was commenced Aug. 8 and completed Sept. 2, 1899. This completed the reach. There are still a few points in the channel below Berkley bridge at which deepening and widening are required.

Martin the channel from the 6-foot contour in the bay to a point north-west of Proctor's Point, a distance of 3,200 feet, was dredged to full width and depth except over two small ledges which project into the channel approximately 20 feet on the eastern side about west of Proctor's Point; 12,935.5 cubic yards of material were excavated.

Wrecks.

In November, 1899, the wreck of the schooner "Ellen Maria," which had been lying about five-eighths of a mile south of the dolphin on White Rock, at the entrance to Lynn harbor, Mass., since 1893, was removed.

Examinations and Surveys.

Under the provisions of the act of March 3, 1899, an examination and survey was made of piers and breakwater at Rockport, Mass. The report on the survey was submitted to the department Jan. 19, 1900, with an estimate of \$22,481.80 for repairing the breakwaters, etc.

Very respectfully,

HARRY TAYLOR,
Captain, Corps of Engineers.

HARBOR COMPENSATION FUND.

There was paid into the treasury of the Commonwealth during the year, under sections 14 and 16 of chapter 19, Public Statutes, and chapter 146, Acts of 1897, in payment for tide water displaced by work done under licenses granted by the Board, and for rights and privileges granted in tide waters and great ponds, the sum of \$70,091.92, which was credited to the harbor compensation fund for Boston harbor. The amount in this fund on Nov. 30, 1900, was \$328,389.55; the income from this fund on the same date was \$30,690.87.

COMMONWEALTH'S FLATS IMPROVEMENT FUND.

The balance in the Commonwealth's flats improvement fund on the first day of December, 1899, was \$516,070.39. To this has been added during the year \$18,630.77 from the income of the fund and \$133,468.50 from sales and rents of lands, making a total of \$668,169.66. Of this sum, there has been expended during the year \$45,339.01, leaving a balance on Nov. 30, 1900, of \$622,830.65.

SALARIES OF COMMISSIONERS.

The attention of the Legislature is again invited to the inadequate compensation of the Board, in the belief that the increased work and responsibility of the commission will receive due consideration.

This commission and the public service met with a genuine loss through the death of Mr. Dominicus Koppmann, on the 3d of January last. He was the consulting engineer of the Board, having been connected with its work in his professional capacity since the organization of the Harbor Commission, in 1866.

Mr. Koppmann was a gentleman of the highest character, conscientious in his public duties, ever courteous and kindly to his associates, and thoroughly entitled to the sincere regard in which he was held by the members of this commission, who desire to place upon record this expression of their appreciation of his character and worth.

The foregoing report is respectfully submitted.

WOODWARD EMERY,
CLINTON WHITE,
CHARLES C. DOTEN,
Commissioners.

Dec. 1, 1900.



1800

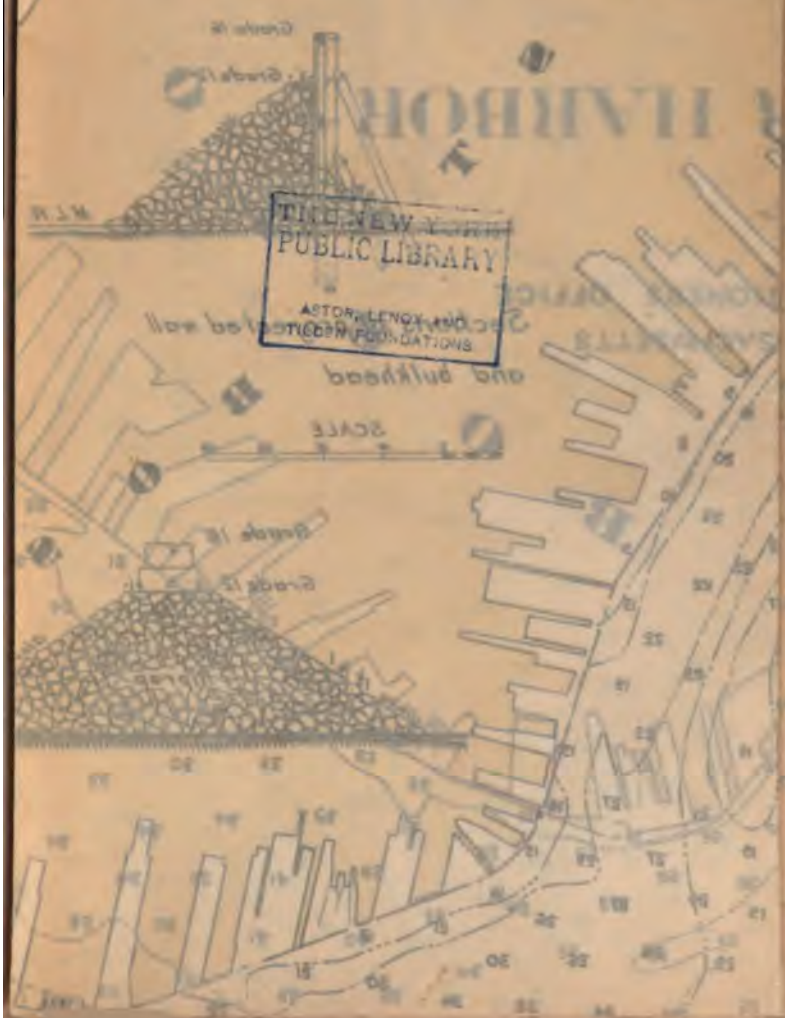
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APPENDIX.

APPENDIX.

[A.]

[See page 4 of this report, *ante*.]

CONTRACTS.

The contracts entered into during the year are as follows :—

1899.

Dec. 6.	With George Hayes & Co., for building an oak pile wharf on the northerly side of the Reserved Channel at South Boston, to be leased to Charles Taft Chapin,—amounting to . . .	\$6,886 00
Dec. 28.	With Michael H. Flynn, for the removal of the wrecked schooner "Wide Awake" in Salem harbor, near the wharf of the East India Fibre Company,—amounting to	285 00

1900.

Feb. 20.	With Forman A. Crosby, for the removal of the wrecked schooner "Anna D. Price" in Beverly Creek,—amounting to	100 00
May 17.	With Cole Bros., for excavating a channel through the inner portion of Lewis Bay, at Hyannis, for the sum of 37½ cents per cubic yard of material dredged from the channel, measured in scows,—amounting to	12,251 57
May 24.	With Augustus B. Martin, for excavating a channel and anchorage basin at Green Harbor, in Marshfield, for the sum of 28½ cents per cubic yard of material excavated from the channel, measured in scows,—amounting to	26,078 79
June 1.	With the Eastern Dredging Company, for dredging in Boston harbor, opposite the Hoosac Tunnel docks, for the sum of 23½ cents per cubic yard of material, measured in scows, and dumped on the Commonwealth flats at South Boston,—amounting to	20,622 69
June 1.	With Augustus Bellevue & Co., for building a wooden bulkhead on the Commonwealth flats at South Boston, for the sum of \$11.18 for each lineal foot of completed bulkhead,—amounting to	12,298 00

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1900.

July 12.	With Augustus Bellevue & Co., for building one oak pile pier and one spruce pile pier on the Commonwealth flats at South Boston, to be leased to Curran & Burton,— amounting to .	\$12,057 00
July 16.	With Augustus B. Martin, for excavating the berths at the piers to be built by the Commonwealth on the Commonwealth flats at South Boston, and leased to Curran & Burton, and widening the channel leading thereto,— amounting to .	12,800 00
July 26.	With Daniel A. Dorey, for constructing wooden catch-basins and pipe drains on the Commonwealth flats at South Boston,— amounting to .	3,398 14
Aug. 27.	With Thomas H. Kiely, for furnishing riprap stone for work to be done on bank of the Connecticut River in Hadley, for the sum of \$1.80 for each cubic yard of stone,— amounting to .	6,886 83
Aug. 24.	With George W. Townsend, for the removal of boulders at Green Harbor, in Marshfield,— amounting to .	403 95
Sept. 7.	With Eugene S. Belden, for extending and strengthening the jetties built under direction of the Board at Menamsha, Lake Anthony and Osterville, for the sum of \$3 for each ton of stone placed in the work,— amounting to .	3,630 00
Sept. 10.	With Luther White, for building a bulkhead at Green Harbor, in Marshfield,— amounting to	152 00
Sept. 20.	With Taylor, Carr & Andrews, for building a concrete sea wall at the Sand Hills, in Scituate, for the sum of \$5 for each lineal foot of sea wall 8 feet high; \$4.75 for each lineal foot of sea wall 6 feet high; 90 cents for each cubic yard of filling furnished and graded in place,— amounting to .	5,408 05
Oct. 12.	With Augustus Bellevue & Co., for extending a pier on the Commonwealth flats at South Boston, built under the direction of the Board,— amounting to .	1,428 00
Total amount,		\$124,181 02

[B.]

[See page 4 of this report, *ante*.]LEASE FROM THE COMMONWEALTH TO CURRAN
AND BURTON.

THIS INDENTURE, made the fifteenth day of June, 1900, between the Commonwealth of Massachusetts, acting by its Board of Harbor and Land Commissioners, of the first part, and Arthur D. Curran of Boston in the County of Suffolk, and Smith P. Burton, Jr., of Reading in the County of Middlesex, doing business in Boston under the firm name of Curran and Burton, of the second part,

WITNESSETH, That the said party of the first part doth hereby demise and lease unto the said party of the second part a parcel of land situate in Boston, being part of the Commonwealth Flats at South Boston, bounded and described as follows, to wit: Bounded on the north-east by a straight line parallel with and fifty (50) feet south-westerly from the bulkhead on the north-easterly side of the filled flats, about 200 feet; on the south-east by land of the Commonwealth leased to the Metropolitan Coal Company; on the south-west by a street or way called Summer street; and on the north-west by a straight line parallel with and two hundred (200) feet distant from the south-easterly boundary line of the granted premises; also two piers, each four hundred (400) feet long, extending out from the bulkhead in front of the premises aforesaid, to be built by the Lessor in accordance with the plan of the premises annexed; and in case the length of said piers is abridged by the appropriation of the in-shore end, for the purpose of a way wider than fifty (50) feet, which the Lessor reserves the right to construct, then the Lessor shall, without expense to the Lessees, extend the piers aforesaid by as much as they are so shortened, if the Lessees so request.

TO HAVE AND TO HOLD the same for a term of five years, beginning with the first day of October next.

YIELDING AND PAYING THEREFOR rent at the rate of sixty-seven hundred and fifty (6,750) dollars yearly, by equal half-yearly payments as follows, to wit: Thirty-three hundred and seventy-five (3,375) dollars on the thirty-first day of March and the same sum on the thirtieth day of September in each and every year during said term, and at that rate for such further time as the

said Lessees or any other person or persons claiming under them shall hold the said premises or any part thereof, the first payment to be made on the thirty-first day of March A.D. nineteen hundred and one.

AND THE SAID LESSOR covenants and agrees with the said Lessees and their representatives, that those paying the rent aforesaid, and performing the covenants herein contained, on their part to be paid and performed, shall peaceably hold and enjoy the said premises without hindrance or interruption by the said Lessor or any person or persons whomsoever; and that if the Lessees, their executors, administrators or assigns shall be desirous of taking a renewed lease of the said premises for the further term of ten years from the expiration of the said term hereby granted, and of such desire, shall, prior to the expiration of the said last mentioned term, give to the Lessor three months' previous notice in writing and shall pay the said rent hereby reserved, and observe and perform the several covenants and agreements herein contained, and on the part of the Lessees, their executors, administrators or assigns to be observed and performed up to the expiration of the said term hereby granted, the Lessor, will upon the request of the Lessees, their executors, administrators or assigns, forthwith execute and deliver to the Lessees, their executors, administrators or assigns a renewed lease of the said premises for the further term of ten years, at the same yearly rent and under and subject to the same covenants, provisos and agreements that are herein contained in this present covenant.

AND THE LESSOR FURTHER AGREES to dredge a berth 18 feet deep at mean low water and 80 feet in width on the east side of the main pier aforesaid, and a berth 12 feet deep at mean low water and 70 feet in width on the west side of said pier; and to dredge suitable connections with a channel which the Lessor agrees to dredge 18 feet deep and 100 feet in width, to deep water. The Lessor will do all necessary dredging for maintaining the channels, but the Lessees must do their own dredging for the maintenance of the depth of the berths inside the line of the pierhead.

AND THE SAID LESSEES for themselves and their assigns hereby covenant with and to the said Lessor that they will, during the said term, and for such further time as the said Lessees or any other person or persons claiming under them, shall hold the said premises, or any part thereof, pay unto the Lessor the said yearly rent, upon the days hereinbefore appointed for the payment thereof, and also all the taxes, water rates and assessments whatsoever, whether in the nature of taxes now in being or not, which may be payable for or in respect of the said premises, or any part

thereof during said term, and for such further time as the said Lessees or any person or persons claiming under them shall hold the said premises or any part thereof; excepting, however, assessments for any permanent benefit or improvement to said premises under any betterment law or otherwise, upon which, however, if made, they agree to pay to the Lessor interest at six per centum per annum on the total amount thereof, payable at the times herein specified for the payment of rent, and, also, will keep all and singular the said premises in such repair as the same are in at the commencement of said term, reasonable use and wear and damage by accidental fire or other inevitable accidents only excepted.

AND THE SAID LESSEES further covenant and promise with and to the said Lessor that they or others having their estate in the premises will not assign this lease nor underlet the whole or any part of the said premises, nor make nor allow to be made any unlawful, improper or offensive use thereof, nor do any dredging upon said premises, without the consent of the said Board first being obtained in writing, allowing thereof; and that it shall be lawful for the said Board at seasonable times to enter into and upon the same to examine the condition thereof; and, further, that the said Lessees and their assigns shall and will be responsible and will pay all damages and charges to the City Government or others for any nuisance made or suffered on the premises during said term; and, further, that the said Lessees and their assigns shall and will at the expiration of said term peaceably yield up unto the said Lessor all and singular the premises in good tenantable repair in all respects, reasonable wearing and use thereof and damage by fire or other casualties excepted.

AND PROVIDED ALWAYS, and these presents are upon this condition, that in case of a breach of any of the conditions to be observed on the part of the Lessees or those claiming under them or in case the estate hereby created shall be taken from them by process of law, by proceedings in bankruptcy or insolvency or otherwise, the Lessor may, while default or neglect continues or at any time after such taking by process of law and notwithstanding any license or waiver of any prior breach of condition, without notice or demand, enter upon the premises and thereby determine the estate hereby created, and may thereupon expel and remove forcibly, if necessary, the Lessees and those claiming under them and their effects.

BUT IT IS AGREED that in case of loss or damage by fire or other unavoidable casualty to the piers aforesaid or either of them, so that the same shall be rendered unfit for use and occupation, that a just and proportionate part of the rent hereinbefore

reserved shall be abated until the same shall have been duly repaired and restored by the Lessor.

IT IS FURTHER UNDERSTOOD AND AGREED that the Lessees and their assigns may erect structures suitable for their business on said premises and may remove the same at the expiration of this lease, but all such structures shall be and exist without charge or liability to the Lessor for creation or destruction from whatever cause; and, further, the Lessees may erect structures suitable for their business across the 50-foot reserved space between the piers and the line of the premises leased, and use said space, without, however, obstructing its free use for passage, as the parties hereto may from time to time agree; but in case said 50-foot passage-way shall be widened at any time the Lessees hereby agree to make at their own expense any reasonable change in the location and form of said structures so as to afford a convenient passage thereunder, to the satisfaction of the said Board.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be executed and delivered under the seal of the Commonwealth, with the approval of the Governor and Council; and the said Curran and Burton, by said Arthur D. Curran and Smith P. Burton, Jr., have hereunto set their hands and seals.

COMMONWEALTH OF MASSACHUSETTS.

By WOODWARD EMERY, }
CLINTON WHITE, } *Harbor and Land*
CHARLES C. DOTEN, } *Commissioners.*

[SEAL.]

ARTHUR D. CURRAN.

[SEAL.]

SMITH P. BURTON.

COMMONWEALTH OF MASSACHUSETTS.

Approved in council June 19, 1900.

E. F. HAMLIN,
Executive Secretary.

COMMONWEALTH OF MASSACHUSETTS.

OFFICE OF THE SECRETARY, BOSTON, June 19, 1900.

Witness the Seal of the Commonwealth:

[SEAL OF THE
COMMONWEALTH.]

WILLIAM M. OLIN,
Secretary of the Commonwealth.

[C.]

[See page 11 of this report, *ante.*]

LETTER OF THE HARBOR MASTER OF BOSTON.

BOSTON, Jan. 3, 1901.

*To the Board of Harbor and Land Commissioners, 131 State House,
Boston, Mass.*

GENTLEMEN:—I would respectfully call your attention to the necessity that exists for increased anchorage accommodations. The anchorage grounds at present are located on both sides of the main channel, one near Bird Island flats, another on South Boston flats, and an anchorage for yachts off Fort Point Channel near the New York & New England docks. There is also an anchorage for two vessels between the East Boston north and south ferries. (The one on South Boston flats has been somewhat curtailed of late, and is liable to be still more so.) These grounds are wholly inadequate for the needs of the port at the present time, and are very often overcrowded, rendering it necessary to anchor vessels outside of the limits. This is owing to the increased tonnage and the increase of draught. It is not an uncommon thing for vessels of deep draught to ground in our harbor, and very often, in order to facilitate the passage of large steamers to the lower harbor, it is necessary to move vessels at anchor from one side of the channel to the other. We have been struggling for a long time under these adverse conditions, and, if we are to accommodate the present needs and prepare for a greater commerce in the future, presaged by the harbor improvements in progress or contemplated, a very much larger anchorage area will have to be provided. The importance of this cannot be too strongly urged, and I hope that some means may be found to provide Boston with sufficient anchorage accommodations in the near future.

The following figures, taken from the harbor master's books, will give a general idea of the condition of the harbor for the year ending Dec. 31, 1900:—

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Average number of vessels per day at anchor in the harbor,	40
Greatest number for any one day,	104
Total number of vessels ordered from the channel,	2,450
Total number of vessels moved from the channel by the harbor master's steamers,	177
Total number of arrivals, foreign and domestic,	11,729

Respectfully submitted,

BYRON F. BRAGDON,
Harbor Master.

[D.]

[See page 47 of this report, *ante*.]REPORT OF ENGINEER IN CHARGE OF CONNECTICUT
RIVER WORK.

To the Honorable Board of Harbor and Land Commissioners of Massachusetts, WOODWARD EMERY, Esq., *Chairman.*

GENTLEMEN : — I herewith submit my report upon the work done the past season under the provisions and appropriation of chapter 100 of the Resolves of 1900, for the protection of the town of Hadley, Mass., against further encroachments of the Connecticut River.

After consulting with your Board, and engineer, Mr. Frank W. Hodgdon, it was decided to expend the appropriation by continuing the protective works up the river, from the point where operations were suspended in 1889, near the head of Middle Street in Hadley.

Contracts were made under your approval with Avon C. Matthews of Northampton for building flat boats to be used in the prosecution of the work, and with Thomas H. Kiely, also of Northampton, to furnish the broken stone for riprapping, and both parties have carried out their part of the contracts in an entirely satisfactory manner.

The same general plan in building the protective works has been followed this season as in years past, — that of covering the slope of the bank, from a height of two to three feet above high-water mark down to the foot of the slope or deepest part of the river, with mats made of poles and brush, interwoven, wired and spiked together, and held in place by a covering or riprap of rough stone.

Before any of the work was laid, the banks were graded to a uniform slope of two to one.

A different method of constructing the submerged part of the mat work has been adopted this season, — that of making it a continuous piece of work, without brakes, instead of weaving and sinking it in sections, as has been done in years past. Following this plan, the work has been done much more expeditiously and at less cost than by the old method ; and much credit is due your engineer, Mr. Hodgdon, at whose suggestion this course was adopted, as well as for the timely hints and advice given by him from time to time while visiting and inspecting the work.

Active operations were commenced August 28, and the work completed, for the season, November 24.

The season was unusually favorable for the work, with but very little change in the height of the river.

The work completed this season extends from the head of the work of 1889, up the river 1,269 feet to a point nearly opposite the old Amherst road leading past the Hadley almshouse, and covers an area of 16,127 square yards, at a cost of 69.7+ cents per yard, including cost of boats and tools, and exclusive of the repairs made in refilling the washout on land of Mrs. John Britt, which cost \$29.55.

At the lower end of the work a lapover was made from 15 to 20 feet in width on the end of the work put in in 1889, to ensure thorough connection between the old and new work; and at the upper end a bulkhead of brush and stone, extending from the top of the bank to extreme low-water mark, has been built in connection with the riprap and mat work, to prevent any undermining in high water at this end of the work.

The work this season has been under the immediate supervision of Roswell S. Gaylord of Hadley, who has discharged his duties faithfully and to my entire satisfaction.

The laborers employed upon the work have been, so far as they could be obtained, residents and tax payers of the town of Hadley.

I assume that your Board will direct that young willows be set in the riprap work at a suitable time next spring, as has been done on work of this kind in years past.

The flat boats are piled up and roofed over, at the head of West Street, on land of C. P. Wood; and the tools used on the work, tool box, ropes and anchors, are stored in Hadley.

To complete the protective works on this reach of the river, it will be necessary to extend the work, another season, up the river, to a point near the mouth of Coleman's Brook.

Respectfully submitted,

E. C. DAVIS,
Engineer.

NORTHAMPTON, MASS., Dec. 3, 1900.

[E.]

[See page 53 of this report, *ante*.]REPORT OF THE SUPERINTENDENT, PROVINCE
LANDS.

PROVINCETOWN, MASS., Dec. 1, 1900.

To the Board of Harbor and Land Commissioners.

GENTLEMEN:—As Superintendent of the Province Lands, I respectfully submit the following report for the year ending Nov. 30, 1900:—

We began work on the lands for the season about the 1st of April, by planting pine seeds and transplanting young pines and shrubs. In planting seed we have made use of four varieties, mixed, viz., Scotch pine (*Pinus sylvestris*), Austrian pine (*Pinus Austriaca*) and native pitch pine (*Pinus rigida*). This seed planting has covered sections of the low lands between the several ranges of sand dunes, and very satisfactory results have been obtained therefrom, notwithstanding the extreme and long continued dry weather following the planting.

The stock transplanted consisted of about 14,000 young pines, taken from the nursery and bogs, and embracing three varieties, about equally divided, viz., Scotch, Austrian and native pitch pine; of the shrubs, about 1,000 Scotch broom (*Genista scoparia*) were taken from the nursery, and a large quantity of the bayberry (*Myrica cerifera*) from the adjacent low lands. This transplanting has been done chiefly along the foot of the slopes of the ranges of the sand hills covered by beach grass, and is showing fairly good results, considering the very unfavorable weather conditions which prevailed for several weeks following the work.

In conjunction with seed planting and transplanting, we proceeded with road construction, and extended it from Grand View Hill in the direction of the Race Point life-saving station, a distance of about 2,300 feet, leaving about 1,900 feet to the outer beach or ocean side of the reservation near the above-named station and the proposed terminus of the road to be done in the future. The completion of this road will furnish a fair driveway from shore to shore, a distance of about 3 miles, the State road being about 2 miles long, and connecting with the town highway about 1 mile from the harbor front.

The transplanting of beach grass was begun about the 1st of May, but on account of continued dry weather it was deemed best after working a few days, to suspend operations until more favorable weather. Work was resumed September 19, and continued during suitable weather until November 18, about 25 acres being covered during the season. A large quantity of bayberry was used in connection with grass planting and among the grass, this shrub proving to be of considerable value, as it is easily transplanted and grows vigorously.

No work has been done in the nursery other than the removal of the plants therein for transplanting purposes.

I am glad to be able to report that the work done during the past seasons shows very satisfactory results, notwithstanding the fact that the weather conditions during this season have perhaps been the worst for work of this character known for years.

During the last three months we have experienced some very severe wind storms, sufficient to move large bodies of sand; yet over the sections of the territory upon which we have operated not the least damage or disturbance is observable.

There is a noticeable improvement of the lands already treated, which encourages belief in the ultimate success of the project.

Respectfully submitted,

JAMES A. SMALL,
Superintendent of the Province Lands.

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ANNUAL REPORT

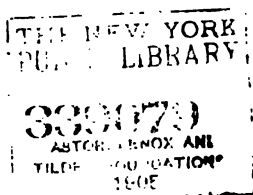
OF THE

BOARD OF HARBOR AND LAND COMMISSIONERS.

FOR THE YEAR 1901.



BOSTON :
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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1902.



Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1901, covering a period of twelve months, from Nov. 30, 1900.

From Dec. 1, 1900, to Nov. 30, 1901, the Board has held 224 meetings, has given 322 formal and informal hearings, and has received 177 petitions for license to build and maintain structures and for privileges in tide waters and great ponds, to dredge material, to remove material from beaches, and for other purposes.

One hundred and twenty-four licenses* for structures and privileges in tide waters and great ponds have been granted during the year; also 37 permits for dredging, for the removal of material from beaches, and for other purposes.

Sixty-five inspections have been made by the Board at various times of work completed and in progress, under appropriations made by the Legislature, in Boston harbor, on the Commonwealth flats at South Boston, the Province Lands in Provincetown, protective works on Connecticut River at Hadley and West Springfield, concrete sea wall on Scituate beach, jetties and channel at West Bay, Osterville, and at Lake Anthony and Menamsha Inlet, Witchmere harbor, Scorton harbor, and location of boundary line between Massachusetts and New Hampshire on Salisbury beach; also of anchorage ground in Boston harbor, proposed location of Northern Avenue and bridge, Ragged Island in Hingham harbor, canal route between Boston harbor and Narragansett

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Bay, Stony beach in Hull, Charles River, Merrimac River, Bass River, Herring River, North River, Scussett River, Sandwich harbor, Apponagansett harbor; also of the sites of proposed work in tide water and great ponds, upon petitions and plans presented to the Board, the location of wrecks and obstructions to navigation, and various structures built under licenses from the Board.

Through transactions of the Board there has been paid into the treasury of the Commonwealth during the past year, from rents, licenses, and sales of land, the aggregate sum of \$59,751.56.

During the year 11 new contracts* were made by the Board, duly authorized for the estimated expenditure of \$152,018.59.

On August 1, the Board executed a bond for a deed of conveyance from the Commonwealth to George C. Corcoran of 31,500 square feet of land on the Commonwealth flats at South Boston, bounded by Anchor, Bullock and D streets, for \$15,750, and other considerations of importance and value to the Commonwealth.

On November 26, the Board executed a deed from the Commonwealth to the trustees of the Boston Real Estate Trust of 188,126 square feet of land on the Commonwealth flats at South Boston, bounded by Summer, D, Fargo and E streets, the consideration being \$263,376.40. This deed was given in accordance with the provisions of a bond from the Commonwealth to the said trustees, dated Jan. 10, 1899.

COMMONWEALTH TIDE LANDS.

On November 26, a license was granted to the Boston & Maine Railroad to extend Pier 5, Hoosac Tunnel Docks, on Charles River, to the harbor line established by chapter 479 of the Acts of 1897. The Board recommended the payment of \$3,615.75 by the licensee for the rights and privileges granted in tide-water land of the Commonwealth to be covered by the proposed extension, and to be used as a dock appurtenant to said extension, the area being 4,821 square feet. This amount was determined by the Governor and Council, Nov. 27, 1901, under section 16 of chapter 19,

* See Appendix A.

Public Statutes, to be just and equitable. The amount thus received will be paid into the compensation fund for Boston harbor, under chapter 146 of the Acts of 1897, the income of the fund being available for use by the Board in the improvement of that harbor.

BOSTON HARBOR.

The deep and sheltered anchorages in the lower harbor of Boston, together with the safe approaches thereto, entitle it to be classed among the best of natural harbors. The need of deeper channels from the wharves to the sea is an oft-told tale, but it is one which must be repeated and reiterated. They are not the needs of caprice or fancy, as all know, but rest on the solid basis of continued commercial prosperity to the capital city of New England, which is the chief natural outlet for exports from the great north-western territory in vessels of modern type.

In 1892 the federal government, whose duty it is to provide the sea coast harbors with sufficient depth of water ways, in order to enable the ports to meet the growing demands of commerce, approved the project for deepening the main ship channel of Boston harbor to 27 feet at mean low water for a width of 1,000 feet, as far up as the south ferry to East Boston. While this work was under way, it was found that when completed, owing to their greater draft, the channel would be inadequate to the requirements of modern ocean steamships, and consequently other projects were matured and entered on for still greater depths of channel.

In 1899 Congress appropriated \$455,000 for the purpose of dredging a new channel from President Roads through Broad Sound to the sea, to be 30 feet deep at mean low water and 1,200 feet wide, and the same is now considerably more than half done.

These projects for improvement, however, failed to keep pace with the increase in the size and depth of the steamships, and still another project was matured, providing for a channel 35 feet deep, and in width varying from 1,200 to 1,500 feet, from the sea up to the Navy Yard and to the first bridges on the Charles and Mystic rivers respectively.

This project passed the lower House of Congress at its last session, but failed in the Senate. It is expected that the same project will be again favorably reported from the rivers and harbors committee, and that an appropriation therefor will be made in the rivers and harbors bill of the Congress now sitting. Every argument and influence in favor of such appropriation should be brought to bear, not only upon our Representatives and Senators at Washington, but also upon all others there having the prosperity and welfare of New England at heart. The voices should never be stilled until our needs in this direction are satisfied.

Within the past decade ocean steamships have grown without precedent in size and capacity. To-day vessels are building for Atlantic carriage with a gross tonnage capacity of 10,000 to 20,000 tons, a displacement from 15,000 to 37,000 tons, and carrying a draft of 28 to 36.5 feet. Among the class referred to, and one of, if not the largest, is the "Celtic," built in 1901. She is 9 feet longer than the "Great Eastern," 1 foot deeper from the same deck, and of 10,700 tons more displacement. Her dimensions, which may somewhat suggest the least extent to which current projects for improving the channels of Boston harbor shall make provision, are as follows: length over all, 700 feet; beam, 75 feet; molded depth, 49 feet; draft when full laden, 36 feet 6 inches; displacement at that draft, 37,700 tons. She can carry 20,900 gross tons, and 2,859 passengers of whom 347 may be first class, at a sea speed of 16 knots.

Economic reasons are the cause which has led to this increase in depth and cargo capacity, and the possibilities of harbor accommodation alone will for some time to come be its limitation. Reduction in the cost of transportation is a constant aim, as is also increase in speed. Both objects are attainable to their extreme limit only by increasing the draft of the vessel proportionately to her length and beam. Consequently, the port that offers the deepest approaches to the wharves will have gained no small advantage.

Other ports are preparing to meet the requirements of these leviathans of the deep, and Boston must not be behind.

At New York the federal government is dredging a channel to the sea 40 feet deep and 2,000 feet wide.

At Liverpool new docks are building, and the sills of others are being lowered.

Bristol, Eng., was granted authority by Parliament at its last sitting to make an expenditure of £2,775,000, or about \$13,875,000, for building docks and terminal accommodations at the Avonmouth, with a view of providing not only for the new type of combined cargo and passenger steamships, but for handling a large passenger service, which it is believed her location, favorable to a fast passenger line to Boston, together with quick train despatch of some two hours to London, will justify.

The railroad consolidations lately authorized by the Commonwealth have placed Boston in a position of favorable competition for exports from the great territory naturally her tributary. The railroads themselves have been and are making expenditures freely, to enable them to offer larger facilities and preserve their economic standard of low cost in handling cargoes. The complete separation of passenger and freight service afforded by the new two-storied shed at the Hoosac Tunnel Docks is not only fulfilment of a long-felt want, but an indication of the permanent growth of transatlantic passenger sailings from this port. It is a distinct encouragement to the belief, entertained by not a few, that the advent of the made-up train of Pullmans, awaiting alongside the passenger shed for passengers to enter as soon as the customs examination of luggage is over, that they may be whirled without delay to their homes in the cities of the west, is not far distant. The passenger accommodations at Liverpool and Southampton have shown this side the water how to do it. The tide of passenger travel is setting towards this port, and attention to the greater comfort and convenience of travellers is alone needed to secure a large and permanent passenger patronage.

The Main Ship Channel. — It is now nine years since the project was adopted by the federal government for improving the main ship channel by deepening to 27 feet and widening to 1,000 feet, at an estimated cost of \$1,250,000.

It may be interesting to note the progress of the improvement. The annual report of work done in this district under the United States engineers in charge since the first appropriation in July, 1892, shows the following:—

The amount expended to June 30, 1900, was \$825,258.18, all upon improvement. With the amount expended during the fiscal year ending June 30, 1901, the channel 27 feet deep between President Roads and Boston was increased in width 500 feet to the full width of 1,000 feet, excepting for a length of 3,400 feet at the "upper middle," where its width is still only 500 feet; but at the "lower middle" several groups of ledges restrict the available width of the channel to 600 feet. On June 30, 1901, the maximum draft that could be carried over the shoalest part of the improvement was 26 feet at mean low water.

The Broad Sound Channel.—The project was approved by Congress in March, 1899, for deepening the channel through Broad Sound to a depth of 30 feet at mean low water for the width of 1,200 feet, at a cost of \$455,000. The work has progressed so that now there is a depth of 30 feet for a width of 775 feet. This channel cannot, however, be made available for use until its approaches have been carefully swept to ascertain if there be any boulders or ledges projecting above the guaranteed depth. As this class of work requires the greatest care and a smooth sea, it will not be done and the new channel buoyed before next summer.

The Thirty-five Foot Channel.—In June, 1900, a survey of the harbor of Boston was authorized by Congress, with a view to provide channels 35 feet deep. A project was reported to Congress in favor of a new channel through Broad Sound into President Roads, 2,000 feet wide and 35 feet deep, to run through the shoals just east of Faun bar. The borings taken in the proposed channel failed to discover any ledge, although one exists just outside which would be dangerous to navigation unless removed. This project included dredging the upper channel to a depth of 35 feet, 1,500 feet wide. Here large quantities of ledge were discovered, which it is estimated will cost \$2,371,770 to remove. The total cost of the project recommended to Congress was estimated in round figures at \$10,500,000. After

suffering a reduction at the hands of the committee of about \$2,000,000, the project which passed the House provided for a channel through Broad Sound 1,500 feet wide and through the upper harbor 1,200 feet, with a depth throughout of 35 feet, and authorized the expenditure of \$8,000,000, with an appropriation of \$3,600,000 available for immediate work.

New avenues of approach need new lights for guidance. Upon completion of the Broad Sound channel, it will have to be buoyed and lighted. To mark the new entrance to the harbor, it becomes necessary to erect a new lighthouse upon or near the Graves, an island or ledge of rocks extending farthest towards Nahant. In order that the new light may be ready to shine as soon as the pathway shall be ready for travel, the Board has communicated with the federal authorities, reciting the needs of the situation, and asking that suitable action may be taken.

ANCHORAGE GROUNDS.

The project presented by the Board in its report last year for the improvement of anchorage grounds between the main ship channel and Bird Island shoal received the sanction of the Legislature by the enactment of chapter 476 of the Acts of 1901. Section 3 of that act requires this Board to obtain from the owners of Bird Island shoal a release of all their right, title and interest therein, without expense to the Commonwealth, before exercising the powers conferred by the act. The title to the shoal is untraceable. It is supposed to have been in the city of Boston, and at the request of this Board the city has executed to the Commonwealth a release of all its right, title and interest thereto. As that release, however, failed to quiet the title, it was thought best to appeal to the Court of Registration for the purpose of having the title of the Commonwealth finally settled. As soon as the question of title is adjusted the Board expects to proceed with the work authorized by the act.

WINTHROP CHANNEL.

Since the dredging of the channel in Winthrop harbor in 1900 there has been a deterioration, and certain shoal spots were found to exist which impeded at extreme low tide the

passage of the steamers accustomed to ply between Boston and Winthrop at schedule hours. A survey made in May, 1901, disclosed the nature and the extent of the shoaling, and a contract was subsequently entered into with the Bay State Dredging Company to remove the same to a depth at mean low water of 9 feet, for 29 cents per cubic yard. The work was completed June 7, 2,586 cubic yards of material having been removed, at a cost of \$749.94. Thereafterwards the steamers made their daily trips during the season, and no complaint of insufficient depth of water has reached the Board. As the channel is narrow and its sides are high mud flats, it cannot be expected to maintain itself without deterioration, and further dredging from time to time will undoubtedly be required. As this channel is not only a highway of passenger travel to and from Winthrop throughout the summer, but also an increased convenience to boatmen of all classes along that shore, it is deemed by the Board to be worthy of improvement.

SHIRLEY GUT.

In April, surveys were made at Shirley Gut to determine the extent of growth at the end of Point Shirley since the survey of the previous year, and also the amount of excavation required to preserve navigation through the Gut. It was found that the rate of increase of the growth had been the same as for previous years, and it therefore became necessary to make a taking of the end of the point for the purpose of enabling the Board to do the required dredging. On April 23, 1901, a taking was filed in the registry of deeds for the county of Suffolk of about 14,000 square feet of land, above high-water mark and flats lying between it and the Gut. Conferences have taken place with the owners, but as yet the Board has not been able to effect a settlement. Subsequently, about 13,000 cubic yards of material was dredged from the point, thereby excavating the channel to the depth of 12 feet at mean low water. It will presumably be necessary to continue this dredging annually, in order to remove the material deposited on the end of the point by the winter storms.

HULL.

The Board was directed, by chapter 483 of the Acts of 1901, to build such sea walls or other structures in the town of Hull as it may deem necessary for the protection of the outer Boston harbor shore from encroachments or damage by the sea, between Allerton and the retaining wall of the New York, New Haven & Hartford Railroad Company, and authorized to expend for this purpose an amount not exceeding \$10,000. This act was approved June 10, 1901, but was not accepted by the town until September 12. Surveys, plans and specifications have been made, contemplating the building of about 1,490 feet of concrete sea wall and about 720 feet of spur jetties; but proposals will not be invited until a more favorable season for the prosecution of the work.

U. S. S. "ENTERPRISE."

Application was received from the Nautical Training School Commissioners, in November, 1900, requesting the Board to dredge a berth for the schoolship "Enterprise," at the North End Park pier. This was accompanied by a statement that no other place could be found for the vessel to lie in, and that the desired dredging was necessary to her safety.

As the proposal was one of an unusual nature, before determining upon the expenditure necessary for the undertaking, the approval of the Governor and Council was requested. That approval having been received, and the permission of the bath trustees of the city of Boston having been obtained, the dock was dredged alongside the bath pier at the North End Park to a depth of 17 feet at mean low water, 45 feet wide on the bottom and 225 feet long, at a cost of \$1,000.

THE COMMONWEALTH FLATS AT SOUTH BOSTON.

This tract of land, comprising about 170 acres of filled land, of which about 70 acres lie north of Summer Street and the balance south of it, remains substantially in the same condition as reported last year. The portion south of Summer Street is laid out with streets crossing each other at right angles, and these streets have been raised above the general level of the flats to grade 16, the established grade

for streets in this section of the city. It is reached from the city proper by Summer Street, which is a high-grade street, crossing the tracks of the New York, New Haven & Hartford Railroad by a bridge. A large part of the necessary drains and catch-basins for the surface drainage of the territory have been built, and are in good condition.

The principal work done during the year has been on the structures on the borders of this property, which are treated under their respective headings.

A dump for refuse material brought from excavations in the city to be disposed of, has been maintained, but the territory used for this purpose has become so nearly filled that the dump will probably have to be discontinued in the near future; in fact, the available territory for disposing of such material near the business section of the city has nearly all been filled.

A temporary use of various portions of the Commonwealth's property has been made during the year, under permits granted by the Board.

With a view to a beneficial effect upon future sales of this property, it is recommended that the Board be granted power, with the approval of the Governor and Council, to make alterations in plans heretofore adopted, and to alter, discontinue or relocate streets or ways.

The artificial channel through the flats, connecting the coal pockets with deep water, was enlarged in January by dredging, at a cost of \$1,000, paid out of the Commonwealth Flats Improvement Fund.

COMMONWEALTH PIER.

Work has been continued on the large new pier at South Boston, now called Commonwealth pier, 1,200 feet long and 400 feet wide, authorized by chapter 513 of the Acts of 1897, which has been under construction during the last four years. The sea wall and filling forming the core or solid portion was completed in 1899, and the oak pile platform, 50 feet wide, surrounding this solid core and forming the face of the pier, in May, 1901.

In order to provide a surfacing material over the clay filling, the Bay State Dredging Company, under a contract

dated May 16, deposited on the pier a quantity of coarse gravel of superior quality, for 35 cents per cubic yard. On May 31, a contract was made with Thomas Meany for carting and spreading this material on and adjacent to the pier, for 30 cents per cubic yard. There were 12,656 cubic yards of gravel placed on the pier, and the whole area of Northern Avenue, opposite the pier and adjoining docks, and about one-third of the area of the pier, were covered to the proposed street grade.

On September 6, a contract was made with the Eastern Dredging Company to complete the dredging in the dock on the westerly side of the pier to the depth of 30 feet at mean low water, the work to be completed Dec. 31, 1901, for 22½ cents per cubic yard. Up to December 1, 46,560.4 cubic yards have been removed, and the balance of the work will undoubtedly be completed within the time named in the contract.

The cost of the work, up to December 1, from the appropriation of \$400,000, has been as follows:—

For sea wall and filling solid to grade 14,	\$215,076 30	
Surveys and supervision,	9,633 69	
	<hr/>	\$224,709 99
For construction of pile platform,	\$128,069 37	
Surveys and supervision,	2,603 24	
	<hr/>	130,672 61
For dredging westerly dock,	\$8,904 68	
Surveys and supervision,	91 00	
	<hr/>	8,995 68
Gravel surfacing,	\$8,226 40	
Surveys and supervision,	180 00	
	<hr/>	8,406 40
Total,		<hr/> \$372,784 68

The amount required to complete the work now under contract is estimated to be about \$6,600.

A number of applications have been made during the year to use the pier for tying up and discharging vessels, but the inaccessibility of the location from the land has prevented the making of any satisfactory arrangements for permanent use.

NORTHERN AVENUE AND BRIDGE.

One step forward was taken during the past year towards securing the necessary additional means of access to the Commonwealth's property at South Boston by the construction of Northern Avenue and bridge, as contemplated by the four-part agreement executed in 1873, under which the Commonwealth, the city of Boston, the Boston Wharf Company and the Boston & Albany Railroad Company began the development of what is now known as the South Boston flats.

Chapter 507 of the Acts of 1901 lays out Northern Avenue, provides for its construction by the city of Boston and for the payment of a portion of the cost thereof by the Commonwealth, as well as for the release by the New England Railroad Company, the successor to the Albany Railroad Company in the ownership of the property, of the land on the South Boston side. The plan of location may be found appended. The act was limited to take effect upon its approval by the city council of Boston. On October 16, the following letter was sent to the mayor of Boston, requesting his early consideration of this matter and its presentation to the city council for action:—

Oct. 16, 1901.

To the Hon. THOMAS N. HART, *Mayor of Boston, City Hall, Boston.*

SIR:—By chapter 507 of the Acts of 1901, the Legislature "laid out Northern Avenue in the city of Boston, from Atlantic Avenue near Oliver Street easterly to Fort Point Channel; thence across said channel by a bridge and thence across lands of the New England Railroad Company and its lessee, the New York, New Haven & Hartford Railroad Company and lands of the Commonwealth."

Northern Avenue would cross the lands of the Commonwealth at South Boston along the water front, connecting the proposed Commonwealth piers, of which the first is now about completed, with Atlantic Avenue and the heart of the city in a direct course at grade.

The act was passed to enable the performance of a prior agreement relating to the filling and improvement of the South Boston flats, whereof the provisions benefiting all the parties thereto except the Commonwealth have been substantially performed.

Under the agreement the benefit to the city has been the creation of land of the present assessed valuation of over \$10,000,000, from which the city derives a portion of her taxes, also 100 acres additional remaining to be sold by the Commonwealth, and which will be taxed by the assessors of Boston. Legislation became necessary in order to enable the city and the other parties to honorably fulfil their obligations under the agreement. That fulfilment will give additional value to the Commonwealth's water front, and provide increased facilities for and accommodation to the commercial interests of the port.

These public benefits are in direct connection with the harbor improvements which are so much a matter of public knowledge as to require no comment here. Before the public can gain the advantages contemplated in this act, it must be accepted by the city council of the city of Boston.

The Board of Harbor and Land Commissioners, in behalf of the Commonwealth, and in the public interest, respectfully asks your early consideration of the foregoing, and requests that you may present the matter to the attention of the honorable city council.

For the Board,

WOODWARD EMERY,

Chairman.

As yet, final action has not been taken. In the event of a failure to accept the act, further legislation may become necessary.

BULKHEAD AND SEA WALL.

As stated in the report of last year, a contract was made with Augustus Bellevue & Co., on June 1, 1900, to build 1,100 feet of bulkhead for the purpose of partially enclosing the area east of the present filled portion of the South Boston flats, which had already been partially filled by material dredged in making various improvements on the Commonwealth's property. This work was completed Aug. 20, 1901.

Paid for construction,	\$12,309 18
Surveys and supervision,	559 23
	<hr/>
	\$12,868 41

The bulkhead is a very substantial structure, and has been reinforced and materially strengthened on its exterior side by broken stone brought from the main channel of the harbor, without cost to the Commonwealth, where it had been

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blasted in the progress of the work carried on by the federal government for the improvement of the ship channel.

After enclosing the northern side of this area, the Board decided to extend the sea wall on its south side parallel with and 300 feet northerly from the northerly side of the reserved channel; and on March 7, 1901, a contract was made with William J. Lawler, the lowest bidder, to build about 1,350 feet of sea wall, at \$56.49 per lineal foot, the work to be completed Oct. 31, 1901. The work was commenced promptly, but, owing to the bad weather encountered in its early stages, the contractor was unable to make the necessary progress with the foundation, and the completion of the work has necessarily been delayed. The foundation is now finished, and the wall proper nearly completed. The amount expended up to December 1 is as follows:—

For construction,	\$54,724 06
Surveys and supervision,	1,183 70
	<hr/>
	\$55,907 76

The amount required to complete the work, including the reserve withheld under the terms of the contract for work already done, is estimated to be \$21,600, or about \$77,500 in all.

This territory is now so enclosed that the work of filling can be proceeded with at any time; the remaining or easterly side should be enclosed by a bulkhead as the work of filling progresses.

BORINGS ON AREA TO BE OCCUPIED BY DOCKS EAST OF THE COMMONWEALTH PIER.

Owing to uncertainty as to the area covered by the ledges which were known to exist along the pierhead line near the shoal called Slate Ledge, it was decided to make a series of borings, in order to ascertain the depth and extent of the ledges and the character of material overlying the same.

Work was begun in the latter part of July, and finished early in November. In all, 94 borings were made, covering an area extending easterly from Commonwealth pier about

3,500 feet. The borings were made to the depth of 40 feet below mean low water, unless ledge was found at a higher grade. The bottom was found to consist of silt covering a bed of clay; over and around the ledge was a bed of gravel and clay hard pan, varying from 4 to 10 feet in thickness. In this layer many large boulders were found.

The ledge along the harbor line was found to be above grade 40 feet below mean low water. It begins at a point about 1,300 feet east of the Commonwealth pier, and thence extends easterly a distance of about 1,700 feet, lying southerly from the harbor line on the area which it is proposed to use for piers and docks for 200 to 300 feet; at only a few places, covering a small area, does the ledge rise above a grade of 30 feet below mean low water. It extends a considerable distance out into the harbor, probably being an extension of the ledges found in the main ship channel, which are now being removed by the federal government. Plans have been made showing the location and results of these borings, and are filed for use in designing future structures.

COMMONWEALTH FLATS AT EAST BOSTON.

The claim of the East Boston Company for that portion of its flats taken by the Commonwealth under the provisions of chapter 486 of the Acts of 1897, for the purpose of preserving the public ownership of a portion of the shore front of the port of Boston, remains unsettled, and is pending in the superior court of the county of Suffolk. It is hoped that the case may be tried during the coming year, and the claim finally disposed of.

Following the lease of the Boston & Albany Railroad to the New York Central & Hudson River Railroad Company, —the latter has been enlarging its accommodations by extending docks and piers, under plans approved by the Board, and making other improvements along the south front of East Boston. The new ownership seems to justify anticipations for increased and constant shipments of western freights and cargoes from this port. Boston has now become one of the Atlantic terminals of the New York Central Railroad, with all its ramifications, from which it can make certain

classes of shipments more advantageously than elsewhere. Under these conditions, we may fairly expect to see a more extended development of that water front and a demand for larger yards. In order to properly handle its growing business, the tracks should come in at the east end of the water front, and thus serve expansion in the easterly direction, where lies the only opportunity for growth.

A commission has been sitting, under the provisions of chapter 390 of the Acts of 1899, for the purpose of eliminating the railroad grade crossings at many intersecting streets, and it has under consideration plans for removing the railroad tracks which now occupy a strip of land through the centre of the island, and placing them on the east side, contiguous to the water front. While there are obstacles to this plan, they are not insurmountable, and the result would afford ready and accessible railroad accommodations to the water front of more than one-half the island.

The Commonwealth is interested in the final determination of this question, as it now possesses a water front area in this vicinity the development of which depends in a measure upon the location of the tracks in solving the grade crossing problem, and the proceedings of the commission are closely watched by the Board and the Attorney-General.

In this connection it may be well to note the change in the harbor line at Jeffries Point, East Boston, by chapter 419 of the Acts of 1901, whereby an opportunity was created to extend future piers and docks for the berthing of vessels of modern size.

FORT POINT CHANNEL.

Early in the year petitions were received from the owners and tenants of the wharves on Fort Point Channel lying between Congress Street bridge and Rowe's wharf, to have the channel in front of their premises dredged, in order that a class of larger vessels might reach the wharves.

The Edison Electric Illuminating Company, the owner of one of the larger wharves, had already excavated a berth in front of its premises to a depth of 25 feet, for a distance of 60 feet from the harbor line.

The United States government had dredged to a depth of 23 feet the centre portion of the channel for a width of 175 feet from deep water in the harbor up to and through Con-

gress Street bridge; the Commonwealth and the Boston Wharf Company had dredged the space between the government channel and the South Boston shore to the same depth up to the wharves.

After examining the locality, it was decided that dredging to the depth of 20 feet from the government channel to a line 50 feet outside the harbor line on the Boston side would accommodate all the requirements of navigation, and plans and estimates were prepared for this work; and on February 14 a contract was made with the Bay State Dredging Company, the lowest bidder, to excavate this area to the depth of 20 feet below mean low water, the contract price being 25 cents per cubic yard. The work was completed in a satisfactory manner June 3, 1901, at a total cost as follows:—

For dredging,	\$14,317 25
Surveys and supervision,	609 48
	<hr/>
	\$14,926 73

which was paid out of the income of the harbor compensation fund.

Fort Point Channel originally had a depth of 8 to 9 feet at mean low water in the deepest part of the channel. As business increased and vessels required a greater depth of water, the Commonwealth dredged a channel up as far as Federal Street bridge, to the depth of 16 feet at mean low water. Shortly after, plans were made by the general government to dredge the channel 23 feet deep and 175 feet wide, and an appropriation was made to begin the work. This was expended in dredging up to and through Congress Street bridge. At that time the foundations of the New England Railroad bridge were not carried to a depth sufficient to enable the channel to be excavated to its full depth through that draw, and work was discontinued until such time as new foundations should be put into the railroad bridge. Since then the railroad bridge has been wholly removed, and Summer Street bridge erected substantially on the same location, so that now the work on the government channel can proceed as soon as further appropriation is made. To this end the attention of the federal government has been directed to the change in the situation. This channel is

greatly needed, as large steamers are constantly arriving with cargoes which should be discharged at the wharves above Mount Washington Avenue bridge, but are unable to get there on account of the shoal water.

The condition of the bridges on this channel is the same as stated in our last report, except that the construction of the approaches to Cove Street bridge is well under way, notwithstanding the work on the bridge itself, both over the channel and over the tracks of the Boston Terminal Company, has not been commenced.

SOUTH BAY.

By chapter 519 of the Acts of 1897, the Legislature provided for the abolition of the grade crossing at Dorchester Avenue, South Boston. The act directed a commission, to be appointed by the superior court, to "prescribe the details for the abolition of the grade crossing by relocating" certain parts of the Old Colony Railroad. By section 2 the Old Colony Railroad is required to construct a part of the railroad so relocated and connections as prescribed by the commission. It is further provided that the Commonwealth shall pay 20 per cent. and the city of Boston 15 per cent. of the cost.

The commissioners thus appointed heard the parties, and prescribed the locations and construction in a report confirmed by a decree of the superior court. In pursuance of this report and decree, the relocation was made and the construction carried on in the tide waters of the Commonwealth in South Bay. Prior thereto, in December, 1898, the Old Colony Railroad Company filed a petition and plans with the Board of Harbor and Land Commissioners, under the provisions of chapter 19 of the Public Statutes, asking the Board "to authorize such construction and filling, and for such further action in the premises as may be authorized or required by the statutes in such case made and provided." Subsequently, before action by the Board, the petition and plans were withdrawn; the work, however, was performed substantially in accordance with said plans, but without the approval of the Board, the railroad company contending that such approval was rendered unnecessary by chapter 519 of the Acts of 1897, and the doings in pursuance thereof.

The Board contended that this special act did not relieve the railroad company from the provisions of the general statutes, and held that they had displaced tide water by filling therein in South Bay, and thereupon, under the provisions of Public Statutes, chapter 19, section 14, assessed upon them the sum of 15 cents per cubic yard for 115,000 cubic yards of tide water displaced, and claimed that a payment of \$17,250 should be made therefor, which claim the Old Colony Railroad Company disputes, and the matter is in the hands of the Attorney-General, to ascertain the legal obligations of the railroad in that respect.

CHARLES RIVER.

The piers of the new Cambridge bridge across Charles River in the place of the old West Boston bridge are slowly rising above the surface of the water. It will be perhaps two years yet before the bridge will be open to public travel, and the temporary structures removed from the river.

The harbor line on the northerly side of the river between Harvard and Brookline Street bridges was changed by chapter 245 of the Acts of 1901, and made to conform to the line approved by the Secretary of War in 1890, for the purpose of establishing a uniform line along the bank, and the parkway of the city of Cambridge has been continued along the river front, in conformity thereto.

The high flats on the shoreward side of this line, between the end of the existing wall on the east and the Grand Junction Railroad bridge on the west, are being filled with material excavated from the river and deposited behind a temporary wooden bulkhead built to retain the same. In carrying out this improvement a large area of mud flats will have been removed from sight, to a minimum depth of 8 feet below mean low water.

Above Market Street bridge, on the Watertown side of the river, the Metropolitan Park Commissioners have done considerable work in excavating the bed of the river to obtain material for building up the banks in the construction of parkways.

By chapter 411 of the Acts of 1901 the harbor line in front of piers Nos. 6 and 7 of the Hoosac Tunnel Docks was changed, thereby obliterating an angle in the old harbor

line, and affording an opportunity for lengthening the dock on the northerly side of Pier No. 7.

During the summer a portion of Pier No. 5, Hoosac Tunnel Docks, was badly injured by fire. In rebuilding the wharf it was extended about 20 feet to the harbor line established by chapter 479 of the Acts of 1897. Owing to the increase in the width of steamers and the narrowness of the dock, 5 feet were cut off from the northerly side of the pier during rebuilding, thus increasing the width of the dock.

CHARLESTOWN DRAWBRIDGE OPENINGS.

On July 1 a letter was received from the city clerk of Boston, requesting approval by the Board, under section 28 of chapter 53, Public Statutes, of the following ordinance passed by the city council of Boston and approved by the mayor June 27, 1901, relating to the hours of opening the draw in Charlestown bridge:—

[ORDINANCES OF 1901, CHAPTER 7.]

AN ORDINANCE RELATING TO THE HOURS OF OPENING THE DRAW IN CHARLESTOWN BRIDGE.

Be it ordained by the City Council of Boston, as follows:

Revised ordinances of 1898, chapter thirty-eight, section three, is hereby amended by inserting in line thirty-four of said section, after the word "tow," the words:—"but he shall not allow any vessel to pass through the draw of Charlestown bridge, so called, except such vessels as shall be ready to go through at the following times: 6.30 A.M., 9.30 A.M., 11 A.M., 12 M., 1.30 P.M., 3 P.M., 8.30 P.M., 11.30 P.M., and from 11.30 P.M. to 6.00 A.M."

IN COMMON COUNCIL, June 20, 1901.

Passed. Sent up for concurrence.

DANIEL J. KILEY,
President.

IN BOARD OF ALDERMEN, June 24, 1901.

Concurred.

JAMES H. DOYLE,
Chairman.

Approved June 27, 1901.

THOMAS N. HART,
Mayor.

A true copy. Attest:

EDWARD J. DONOVAN,
City Clerk.

Public notice was given that the Board would hear all persons interested in the granting or refusing approval of the ordinance above recited, at the office of the Board, on July 8, 1901; and on that date parties in favor of and those opposed to the approval of the ordinance were fully heard. After consideration of the matter, the Board on August 1 took action, as will appear in the following letter:—

BOSTON, Aug. 1, 1901.

A. J. BAILEY, Esq., *Corporation Counsel, Boston, Mass.*

DEAR SIR:— After carefully considering the schedules of the hours for opening the Charlestown bridge for the passage of vessels, as submitted, the Board is not satisfied that there is a sufficient number of openings to meet the requirements of navigation, and therefore cannot give its approval.

The Board respectfully suggests some further inquiry, with a view to ascertaining if the interpolation of another time of opening, between 9.30 and 11 A.M., and two more at a little after 4 and 7 P.M., would not better subserve the interests of navigation without materially increasing the impediment to travel necessarily occasioned by opening the draw; and would draw attention to the consideration that the addition of the three openings suggested would still be two less than the thirteen openings provided by the railroad companies.

Yours truly,

WOODWARD EMERY,
Chairman.

MYSTIC RIVER.

There has been no change in the physical condition of this river since the report of last year, beyond the completion of the Malden bridge, in accordance with plans approved by the Board. The draw in the new bridge was made 50 feet wide to accommodate the increasing size of craft.

During the year, claims for displacement by filling on the west side of the river have been made up and put into the Attorney-General's hands for collection. These claims are liable to be contested, on the ground that prior legislation has exempted the owners of flats on that side of the river, within a limited territory, from the payment of compensation for tide water displaced. These contentions raise questions of law which it will be necessary to take to the supreme judicial court for decision, before the rights and obligations of

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the Commonwealth and the contending parties can be ascertained and settled.

Under the project of the federal government, 86,511 cubic yards of material were dredged below the mouth of Island End River, giving a depth of 25 feet at mean low water in the channel.

The New England Gas and Coke Company have continued their improvements by dredging and the building of structures in Island End River, in accordance with plans approved by the Board. In all they have removed 397,552 cubic yards by dredging in the Mystic and Island End rivers, adjacent to their property.

WEYMOUTH FORE RIVER.

Among the licenses granted during the year, none presages more of benefit and prosperity to the water side of Boston than those permitting improvements and the erection of structures in tide water at the works of the Fore River Ship and Engine Company, on Weymouth Fore River, at Quincy.

Shipbuilding at the port of Boston is reviving. In place of the wooden clipper ships of the last century, we are now building steel vessels of modern type and design. One of the largest and the best-equipped steel ship building plants in the country is rapidly developing on this river, the water of which runs into Hingham bay, with a depth sufficient to float battle ships now building of 15,000 tons and upwards, thence through Nantasket Roads into the main ship channel of Boston harbor.

In order to enable vessels built at the works of this company to pass out of the river, the county commissioners of Norfolk, in rebuilding the Quincy and Weymouth bridge, have provided for two draw openings, each 100 feet in width.

MERRIMAC RIVER.

On October 8, a petition was received from Samuel W. George and other prominent citizens for a relocation and extension of the harbor line on the northerly side of the Merrimac River, in Haverhill, "to such an extent and in such manner as the Board may deem necessary to meet the requirements of business and public interests."

Pursuant to the provisions of law, the Board caused notice to be published, and on November 21 gave a public hearing in the city hall in Haverhill to the petitioners and all persons who desired to be heard on this subject.

The present harbor line was established by chapter 104 of the Acts of 1883, but, owing to the growth of business and changes in local conditions, the petitioners wish to have a new line established which will permit the erection of structures farther into the river, and at the same time give an opportunity for building a quay or bulkhead in water of sufficient depth to float a loaded barge or vessel.

It is recommended that a new harbor line be established, in accordance with a plan on file in the office of the Board.

CONNECTICUT RIVER.

In the spring of the year willow cuttings were planted in the banks of the river, where they were protected by the riprapping done during the previous year, that being a stretch of about 1,269 feet to a point nearly opposite the old Amherst road, running past the Hadley Almshouse. The willows are expected in this case, as heretofore, to spread their roots and form a solid network, thus holding in place the riprapping, and forming a perfect protection against the action of the current, waves and ice.

The river was inspected during the great freshet in April, when it rose as high or higher than at any time during the past thirty years; apparently no wind accompanied the freshet, and but little damage was done. No injury was occasioned to the banks where they had been protected under prior appropriations by the Legislature.

Later, the selectmen of Hadley were given authority to repair any injury to the banks within their town which have been protected through the agency of the Commonwealth.

In July, the Board, in pursuance of the authority and appropriation granted by chapter 94 of the Resolves of 1901, made a contract for protecting the banks at Hadley, from the end of the work done last year to a point near the mouth of Coleman's Brook, and employed E. C. Davis of Northampton to superintend the work. During the season the members of the Board, with the engineer, made inspections

of the work while it was progressing and upon its completion. The work was satisfactorily accomplished under the same method as had theretofore been successfully adopted, and was completed November 5.

The section of river bank treated this year extends from the northerly end of last year's work up the river to Coleman's Brook, — a distance of 1,455 feet. The area covered by the mats and riprapping is 19,989 square yards, at a cost of $53\frac{1}{2}$ cents per square yard, making a total cost for the entire work, including surveys, plan and estimate for proposed dike below the highway, of \$10,660.78.

Owing to some favorable circumstances, and the personal qualifications of the overseer in charge of the work, a considerable reduction in the cost per square yard of last year's work, which was $69\frac{7}{10}$ cents, is noticeable.

The completion of the protective works from the head of Front Street in Hadley around the "high banks," so called, to Coleman's Brook, includes a distance of 5,100 feet, or nearly a mile, and will in the future afford protection to the main part of the town from further encroachments of the river.

No other portion of the river bank in the town is exposed to the influences which have hitherto encroached upon the land now thoroughly protected; and no danger need be apprehended except from a small break below the highway, which will have to be protected by a dike, for which plans and estimates have been made, and the cost of which will be well within the unexpended balance of the appropriation already made.

In the prosecution of the work it became necessary to purchase some equipment, in the nature of scows, which could not be hired, together with tools and material, for which there is no further need; and it is recommended that authority be given the Board to sell such things after the entire work is completed, and turn the proceeds in to the treasury of the Commonwealth.

The unexpended balance of the appropriation now available is \$7,728.01.

The report * of the engineer in charge may be found in the Appendix.

* See Appendix B.

NEW BEDFORD AND FAIRHAVEN BRIDGE.

It will be remembered that chapter 99 of the Resolves of 1899 constituted the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners a joint Board for the purpose of investigating and reporting upon the subject of relocating and widening the New Bedford and Fairhaven bridge over the Acushnet River.

The joint Board made its report to the Legislature, (House, No. 278) on Jan. 22, 1900. The Legislature adopted the report, and, by chapter 439 of the Acts of 1900, constituted the said commissions a joint Board to prescribe the manner in which so much of the highway, bridge and approaches as remained to be completed should be constructed, and to approve all plans, specifications and requirements necessary to finish the undertaking.

As stated in the report of last year, the joint Board, under the provisions of chapter 439 of the Acts of 1900, approved the contract and specifications for building a temporary bridge, and also removing the old bridge.

On Jan. 25, 1901, after hearings, duly advertised, at which all persons interested had an opportunity to appear before the Board and be heard upon all matters pertaining to the completion of the bridge under the provisions of chapter 439 of the Acts of 1900, the following order was passed:—

ORDER.

COMMONWEALTH OF MASSACHUSETTS.

In Joint Board of the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners of the Commonwealth.

In Re RELOCATION AND COMPLETION OF THE BRIDGE OVER THE ACUSHNET RIVER BETWEEN THE CITY OF NEW BEDFORD AND THE TOWN OF FAIRHAVEN.

Board of Railroad Commissioners: Hon. James F. Jackson, chairman; George W. Bishop; Hersey B. Goodwin. Board of Harbor and Land Commissioners: Hon. Woodward Emery, Chairman; Clinton White; Charles C. Doten. Hon. Woodward Emery, chairman of joint Board.

At a meeting of the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners, sitting as a joint Board

by virtue of the authority of chapter 439 of the Acts of the year 1900, at which all the members were present, held this twenty-fifth day of January, 1901, it was adjudged as follows, to wit:—

Whereas, by act of the Legislature, Resolves 1899, chapter 99, it was “*Resolved*, That the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners, who are for this purpose constituted a joint Board to act by a majority vote of all the members thereof, are directed to consider the matter of the completion of the New Bedford and Fairhaven bridge over the Acushnet River, and to report to the next General Court, on or before the fifteenth day of January, what has been the expense of said bridge as far as constructed; also to report how and in what manner the bridge and the approaches thereto on the New Bedford side should be completed, including the abolition of any railroad grade crossing, the probable expense thereof, and by whom the work should be done, and by what parties the expense should be borne and paid; and that no contracts be made by the county commissioners of Bristol County in respect to said bridge until authorized by the General Court”;

And whereas, in pursuance of said resolve, the said joint Board made a report to the Legislature, as follows, viz.:—

COMMONWEALTH OF MASSACHUSETTS.

REPORT OF THE JOINT BOARD UPON THE SUBJECT OF RELOCATING AND WIDENING THE NEW BEDFORD AND FAIRHAVEN BRIDGE OVER THE ACUSHNET RIVER.

To the Honorable the Senate and House of Representatives of the Commonwealth in General Court assembled.

By chapter 99 of the Resolves of 1899, the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners were constituted a joint Board for the purpose of investigating and reporting upon the subject of relocating and widening the New Bedford and Fairhaven bridge over the Acushnet River. The resolve reads as follows:—

RESOLVE TO PROVIDE FOR AN INVESTIGATION BY THE BOARD OF RAILROAD COMMISSIONERS AND THE BOARD OF HARBOR AND LAND COMMISSIONERS RELATIVE TO THE RELOCATING AND WIDENING OF THE OLD BRIDGE OVER THE ACUSHNET RIVER BETWEEN THE CITY OF NEW BEDFORD AND TOWN OF FAIRHAVEN.

Resolved, That the board of railroad commissioners and the board of harbor and land commissioners, who are for this purpose constituted a joint board to act by a majority vote of all the members thereof, are directed to consider the matter of the completion of the New Bedford and Fairhaven bridge over the Acushnet river, and to report to the next general court on or before the fifteenth day of January, what has been the expense of said bridge as far as constructed; also to report how and in what manner the bridge and the approaches thereto on the New Bedford side should be completed, including the abolition of any railroad grade crossing, the probable expense thereof, and by whom the work should be done, and by what parties the

expense thereof should be borne and paid; and that no contracts be made by the county commissioners of Bristol county in respect to said bridge until authorized by the general court. [Approved June 2, 1899.]

The joint Board published notices in sundry newspapers, in order to give all persons interested an opportunity to be heard, and gave hearings at the office of the Railroad Commissioners in Boston. They also personally pursued inquiries and made investigations. In a body they inspected the locality of the proposed bridge at New Bedford, and all places in the vicinity which might tend toward aiding in a solution of the questions involved.

The interests to be affected were represented by eminent counsel, who laid before the joint Board the history of proceedings relative to the bridge from its inception; presented the points of view and the interests both of public and private nature involved in the undertaking, and prepared and argued elaborate printed briefs in support of their contentions. Stenographic reports of the hearings before the legislative committee of last winter, and of a hearing before the Grade Crossing Commissioners, appointed prior thereto, were placed in the possession of the Board, and freely referred to.

After fully hearing all desiring to be heard and carefully considering the questions presented, the joint Board unanimously concur in answering the questions submitted to it by the Legislature as follows:—

I. With Reference to the Expense of said Bridge as far as constructed.

The treasurer of the county of Bristol reports that the whole amount expended on account of the New Bedford and Fairhaven bridge from the first itemized charge in 1894 down to Jan. 1, 1900, is \$810,932.30. This sum includes:—

The construction account of the bridge proper, . . .	\$632,078 09
The land damage account,	129,854 21
The interest on county notes,	49,000 00

II. How and in what Manner the Bridge and the Approaches thereto on the New Bedford Side should be completed, including the Abolition of any Railroad Grade Crossings.

The Board did not consider this as a purely grade crossing question, but as one involving the proper approaches of an expensive highway bridge, 70 feet wide, with some attempt at architectural effect, and realized that it should be studied with reference to its having been already more than half built, and to its being finished with some regard to the wishes of the community upon whom would fall a large part of the burden of paying for it.

In this deliberation, the existence of a steam railroad crossing, with its necessarily attendant dangers and inconveniences, was an essential factor.

A brief review may aid in comprehending the present situation. An ancient highway, 30 feet in width, crossed the Acushnet River between the town of Fairhaven and the city of New Bedford by a bridge and

over the intervening Pope's and Fish islands. On the New Bedford side this highway was intersected by the tracks of the Old Colony Railroad at grade, in the year 1873, and trains for passengers and freight have since passed and repassed along the water front of the city daily, at frequent intervals intercepting public travel over the highway.

The Union Street Railway was granted a location in the highway in 1872, and has since operated its cars therein and across the Old Colony Railroad, at grade.

In May, 1893, by chapter 368 of the Acts of that year, the Legislature authorized the county commissioners of Bristol County to rebuild the bridge between New Bedford and Fairhaven, and limited the expense thereof to \$200,000. The same act also authorized the commissioners to construct the approaches at a common grade with the railroad, should they deem it advisable, or to require the mayor and aldermen of New Bedford to institute proceedings under the grade crossings act, chapter 428 of the Acts of 1890, when the question would be left to the commission appointed by the superior court.

Under the authority of the act of 1893, the county commissioners caused plans to be made for both a grade and an overhead bridge. In 1894, by chapter 239 of the Acts, the Legislature authorized an increased expense of \$150,000, thereby limiting the cost to \$350,000, which was to be exclusive of land damages; and, upon petition of the citizens of Fairhaven and Acushnet, by chapter 530 of the Acts of that year, allowed a change in the eastern terminus of the bridge.

From 1894 to 1896 various plans were proposed for the abolition of a number of grade crossings in New Bedford, including the Bridge Street crossing, but the city and railroad were unable to agree on any plan.

On July 11, 1896, the county commissioners, after a number of hearings, decreed that in their judgment the public convenience and necessity required that the bridge should be constructed at grade with the railroad. In August, 1896, the commissioners awarded a contract for construction between Fairhaven and Fish Island, according to plans approved and decreed by them. At that time they were authorized to expend only \$350,000, exclusive of land and other damages. During the winter of 1896 and 1897, it was found that the appropriation heretofore made was insufficient, and the Legislature was asked to authorize an additional amount, which was given by chapter 200 of the Acts of 1897, making the total \$450,000.

During that year, owing to the requirements by federal authority for a draw with two openings, of 100 feet each in width, the county commissioners found that they would be unable to complete the bridge as they had planned (at grade) for the amount allowed by the Legislature, and asked for authority to spend more money. By chapter 387 of the Acts of 1898 they were authorized to expend for the total construction of the bridge, without damages, \$800,000, thereby increasing the original authority \$600,000, or 300 per cent. The same act would seem to confirm the action of the county commissioners in laying out the bridge at grade with the railroad. The original decree of July 11, 1896, estab-

lished the bridge at grade across Fish Island; but by a decree of the commissioners, May 23, 1898, following the fixed elevation of the draw, a new grade was determined, by which the roadway was raised an average of 7½ feet across the island.

In January, 1899, a bill was presented to the Legislature, making it mandatory upon the county commissioners to construct the bridge and approaches thereto on the New Bedford side over the tracks, providing that the western approach should not be farther west than Acushnet Avenue, and that the difference in cost above that for a grade bridge should be apportioned under the grade crossing act of 1890. Said difference in cost would amount, for construction and including damages, probably \$700,000, making the total cost about \$1,500,000; and of this extra cost it was proposed to apportion 25 per cent. on the Commonwealth, 65 per cent. on the railroad and the balance on parties benefited, as provided in the original act.

Various amendments were proposed to this act, and toward the end of the session a new bill (Senate, No. 337) was proposed, which authorized the superior court to appoint a commission who were to have power to say whether the bridge should be built overhead or at grade, and to apportion the cost upon the Commonwealth, the railroad and the city. This bill was rejected, and the whole subject of completing the bridge was placed in the hands of the joint Board of Railroad Commissioners and Harbor and Land Commissioners, to report to the Legislature their findings.

A careful study of the legislation and the testimony submitted would seem to indicate that it was not the original intention to build such a structure as has already been erected, and the amount of money so far expended is far in excess of what public convenience and necessity required. At present, however, there exists a very expensive structure, now partially completed; and the citizens of New Bedford are not satisfied that the bridge shall end as was originally intended, but wish to have it carried farther into the city. This local sentiment is strong. It was apparent at the hearings before the joint Board, where, in the brief of counsel, it was suggested that the city was ready to bear an unusual portion of the expense pertaining to the overhead structure. Recent acts of the city council of New Bedford confirm this attitude.

The railroad crossing at the western location of the bridge is an extension from the New Bedford depot to the wharves, for the purpose of reaching their steamboat connections and to carry freight to and from private wharves, and is not used by express trains, and in this respect may be differentiated from the more important grade crossings on main lines. The danger, however, at this particular crossing is emphasized by the existence of an electric railway, which has practically secured an exclusive right of way across this bridge, and promises to become the New Bedford end of a growing system.

With this situation facing us, a difficult problem is presented. Danger is a word of as uncertain significance as there are minds to be affected by it. Few would have the hardihood to deny its existence at this crossing, or that with the passage of time and the growth of population and

business it would not materially increase, even if minimized for the present by restrictions and regulations.

The policy of the Commonwealth as to the separation of grade crossings is firmly established, as is its rule against permitting electric railways to cross steam railways at grade whenever it can be avoided. The large number of occasions in which, from various causes, electric cars become stalled while crossing steam railroad tracks, may be cited as testimony in confirmation of the wisdom of this rule. For this reason the Legislature has passed an act authorizing electric railway companies to take land for the purpose of constructing bridges over or ways under railroad locations.

In view, then, of the existence of a partially constructed bridge of magnificent proportions; of the strong sentiment in and demand of New Bedford that it shall be finished as an overhead structure across the railroad tracks, and avoiding Bridge Square as a terminal; of the existence of danger and inconvenience of a public grade crossing at this place; and of the added peril by reason of the presence of an electric railway, promising to be double tracked and the end of a system in the near future,—the joint Board has finally reached the unanimous conclusion to recommend the abolition of the public grade crossing at Bridge Street, and the construction of an overhead bridge. This will unavoidably leave a *private* crossing for the abutters between the railroad and the river, which will have to be preserved *as are the other private* crossings further to the south, and to this extent will prevent *the entire elimination of this grade crossing.*

III. *As to the Probable Expense thereof.*

It was early seen that the expense of carrying an overhead bridge structure, with proper approaches, into the city of New Bedford, would be very great. It was fully recognized that the expenses thus far incurred are in many quarters deemed most lavish and extravagant, have become a subject of general comment and stricture, and excited apprehension on the part of tax payers; and that the city of New Bedford, however much her citizens might desire to have this work carried out to completion on the scale upon which it had begun, could not disregard the fact that she already was burdened with a heavy tax rate.

Several plans were presented to the joint Board. One contemplated beginning at the east side of Fish Island, and ending at Second Street. Two other plans were shown,—one more and one less expensive to build. The first of these latter plans would involve the payment of additional grade damages on Fish Island, and a large amount on the New Bedford side. This was urged, as affording the finest approach into the city of New Bedford, as comporting with the dignity and character of the entire bridge structure, and as creating an opportunity for advantageously widening adjacent streets and furnishing a boulevard for the embellishment of the city. Estimates were given of the cost at from \$642,000 to \$750,000. It seemed to the Board that something satisfactory from the esthetic as well as the utilitarian point of view could be accomplished at considerably less cost; and after due deliberation it

was concluded that an elevated structure, 70 feet wide, to begin at the west side of Fish Island, and rising at a grade of less than 3 per cent. to an elevation over the railroad track that would give 16 vertical feet in the clear for car space underneath, and thence descending, by a grade not to exceed 3 per cent., to Water Street, would meet and fulfill all the requirements of the situation.

As no appropriation for furnishing the Board with the services of an expert bridge engineer to deal with this purely technical problem of architectural engineering had been provided, the joint Board was obliged to rely largely upon gratuitous advice and assistance in making this estimate.

The joint Board is of opinion that the total expense, including land and grade damages, of completing the way as already laid out across Fish Island, and of constructing an overhead bridge, beginning at the western end of Fish Island, crossing the channel and the railroad and landing at Water Street, ought not to exceed the sum of \$450,000. This estimate, while large, is not calculated to provide for any further payments of damages excessively disproportionate to assessed valuation.

IV. *By whom should the Work be done?*

In view of the extravagant expenditure of public money by the county commissioners, and the fact that the remaining portion of the bridge to be built is within the limits of New Bedford, it seems proper to suggest that city as the most fitting and suitable party to proceed with the completion of the undertaking. It is for her interest that it should be done as economically as may be, for on her will fall a great part of the burden. She will also be better able to provide for and adjust the approaches through her streets to meet the termination of the bridge proper within her limits.

The railroad company disclaims any desire to build that portion of the structure to be erected within the lines of the railroad location, but is willing that it should be done by the city. Furthermore, the other parties interested will be watchful for careful and economical expenditures.

It is accordingly recommended that the city of New Bedford be the party by whom the work should be done.

V. *By what Parties the Expense thereof should be borne and paid.*

In view of all the foregoing and of the peculiar conditions which exist, and of the unusual character and proportions of the bridge, and also of the fact that a *private crossing with its attendant expense and dangers is left for the railroad company to deal with as best it may*, it is obvious that it would be unjust to expect the Commonwealth and the railroad company to pay more than an equitable proportion of the cost of abolition. Such deviation from the grade crossing act of 1890 has been recognized when special conditions have called for apportionment of cost adapted to the peculiar circumstances of the case.

The city of New Bedford presents no claim to be exempt from bearing her full share of a great improvement, from which, more than all other parties, she will derive benefit and satisfaction.

34 HARBOR AND LAND COMMISSIONERS. [Jan.

The Union Street Railway Company would be the recipient of benefits from the proposed elevated structure that would justify charging to it a portion of the expense thereof. The Union Street Railway Company has secured privileges from New Bedford, Fairhaven and the county commissioners, with a view of being confirmed in exclusive occupation of this bridge with its railway. Without discussing the scope or validity of these privileges, there is little doubt of a continuance of its possession of an exclusive location over the bridge. Street railway accommodation is needed, and so long as it is given by this company it is not likely that any disturbance of occupation will take place. The bridge was widened in order to give space for the tracks of the railway without incommoding other traffic.

The Legislature has recognized by general laws and by special enactments the propriety of imposing upon street railways, under special conditions, a portion of the expense of public improvements by which they were particularly to be benefited.

The joint Board feels justified, in this case, in recommending that the Union Street Railway Company be assessed a fair percentage of the cost of all the New Bedford end now remaining to be built.

The town of Fairhaven would receive a distinct, special benefit from its abolition, and therefore should bear a part of the expense.

The expense already incurred in building the bridge from the Fairhaven shore to Fish Island is too great to justify the suggestion that any towns in Plymouth County be charged with a contribution larger than is limited by chapter 460 of the Acts of 1899.

While the resolve does not in words require a report on the proper apportionment of the expense upon the parties by whom it should be borne and paid, nevertheless, considering the true purpose and intent of the resolve, it is believed that the report would be considered incomplete unless a recommendation to that effect were included. Indeed, to fix the proportions is but a step beyond discriminating the parties.

The joint Board has estimated that an expense of completing the bridge, in the manner hereinbefore recommended, by an overhead structure, ought not to exceed \$450,000. The estimate of \$220,000 for completing the bridge at grade has been given by other reliable authority. The difference between these two amounts, that is, the sum of \$230,000, would seem, then, to be properly chargeable to the overhead structure, and to be the sum fairly to be apportioned by this report. As, however, this sum is but an estimate, and liable to variation, it is recommended that the expense of that portion of the bridge under consideration, whatever it may ultimately be found to be, shall be divided and paid as follows:—

The Commonwealth to pay 12 per cent., in no event to exceed	\$30,000
The New York, New Haven & Hartford Railroad to pay 33 per cent., in no event to exceed	90,000
The Union Street Railway Company to pay 10 per cent., in no event to exceed	25,000
The town of Fairhaven to pay 5 per cent., in no event to exceed	12,500
The city of New Bedford to pay the balance.	

The sum of \$220,000 which is the estimate for finishing the bridge at grade is left to be apportioned under the terms of the original bridge act.

It is further suggested that any bill drafted in pursuance of these recommendations should contain provision to secure an application of the betterment law in all suits brought for damages to private property.

WOODWARD EMERY, *Chairman,*

JAMES F. JACKSON,

GEORGE W. BISHOP,

HERSEY B. GOODWIN,

Board of Railroad Commissioners.

CLINTON WHITE,

CHARLES C. DOTEN,

Board of Harbor and Land Commissioners.

And whereas, by chapter 439 of the Acts of the year 1900, entitled "An Act relative to the relocation and completion of the bridge over the Acushnet River between the city of New Bedford and the town of Fairhaven," it was enacted as follows, viz.:—

SECTION 1. The board of railroad commissioners and the board of harbor and land commissioners, who for this purpose are constituted a joint board to act by a majority vote of all the members thereof, shall prescribe the manner in which so much of the highway, bridge and the approaches thereto, between the city of New Bedford and the town of Fairhaven, as has not been constructed by the county commissioners of the county of Bristol, under the provisions of chapter three hundred and sixty-eight of the acts of the year eighteen hundred and ninety-three, and all acts in amendment thereof and in addition thereto, shall be constructed and completed, and, except as herein otherwise provided, maintained by the city of New Bedford, from the east side of Fish Island to the east line of Water street, *in accordance with the recommendations and report of said joint board* to the general court of the year nineteen hundred, and *in accordance with plans, specifications and requirements to be adopted and approved by said joint board, and by them duly filed in the registry of deeds for the county of Bristol, southern district*; and said city in the construction and completion thereof, as thus prescribed, shall exercise all the powers and perform all the duties pertaining thereto imposed upon said county commissioners by said acts, not inconsistent therewith.

SECTION 2. The city of New Bedford is hereby authorized and directed to locate and lay out anew said bridge and the approaches and way leading thereto, *in the manner prescribed by said joint board*, and to take therefor, by purchase or otherwise, the private property of persons and corporations, as provided in section four of chapter three hundred and sixty-eight of the acts of the year eighteen hundred and ninety-three, in relation to the taking of lands by the said county commissioners. All proposals for bids for the construction of the whole or any portion of said bridge by said city shall be expressed therein, to be subject to the right of said city to reject any and all bids not approved in writing by said joint board.

And whereas, due notice was given to all parties interested by said joint Board, of the time and place of hearing, at which time and place the city of New Bedford was represented by the Hon. Charles S. Ashley, mayor of the city of New Bedford, William F. Williams, city engineer, and Thomas F. Desmond, special counsel for said city; the Old Colony Railroad Company by the Hon. J. H. Benton; the Union Street Railway Company by the Hon. C. W. Clifford and Oliver Prescott, Jr., Esq.; the owners of Parker's block by said C. W. Clifford; the firm of Garfield & Proctor by said C. W. Clifford; and the firm of Anthony, Swift & Co. by Freedom Hutchinson.

Now, therefore, after due notice to all parties interested, and hearing given to all parties interested, present and desiring to be heard; it was unanimously —

Voted, That we, the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners, sitting as a joint Board, in pursuance of the provisions of chapter 439 of the Acts of the year 1900, do hereby "prescribe the manner in which so much of the highway, bridge and the approaches thereto, between the city of New Bedford and the town of Fairhaven as has not been constructed by the county commissioners of the county of Bristol under the provisions of chapter 368 of the Acts of the year 1893, and all acts in amendment thereof and in addition thereto, shall be constructed and completed, and, except as otherwise provided by chapter 439 of the Acts of the year 1900, maintained by the city of New Bedford from the east side of Fish Island to the east line of Water Street, in accordance with the recommendations and report of the joint Board to the General Court of the year 1900," as follows: —

I. We prescribe the construction of an overhead bridge from the east side of Fish Island to the east line of Water Street in the city of New Bedford, in the manner hereinafter provided, but upon the condition that there shall be reserved upon and over the location and tracks of the railroad company, for the benefit of the estates abutting upon Bridge Street between the railroad and the river, an open crossing at grade, free from the obstruction of gates or bars, to be planked and maintained by the railroad company for the time being in possession.

II. We prescribe that the existing way leading from the river to Bridge Square, except as to that portion within the location of the railroad, shall be forever maintained and kept in repair by the city of New Bedford as an approach to the bridge for the benefit of the estates abutting thereon; and that the bridge over said existing way shall be constructed with due regard to convenient

access for ordinary traffic to and from the abutting estates, in accordance with the plans and specifications for building the bridge approved by the joint Board.

III. We prescribe the construction and completion of so much of the highway, bridge and approaches thereto between the city of New Bedford and the town of Fairhaven as lies between the east line of Water Street and the east side of Fish Island upon and over the following described location, viz.: the north line begins at a point in the east line of Water Street seventy (70) feet northerly in said east line from the north line of Middle Street, thence easterly in a straight line parallel to and seventy (70) feet distant from the north line of Middle Street, one hundred fifty-six and seven hundredths (156.07) feet; thence in a curve whose radius is fifty (50) feet and angle of intersection twenty-one degrees, thirty-three minutes, fifteen seconds ($21^{\circ} 33' 15''$) to the north, eighteen and eighty-one hundredths (18.81) feet; thence in a straight line tangent to said curve, sixty-two and three hundredths (62.03) feet to a boundstone called "number one" in the New Bedford bridge decree of the county commissioners of Bristol County, dated July 11, 1896; thence in a continuation of the same line easterly one hundred fifty-two and nine tenths (152.9) feet to a boundstone called in said decree "number two," in the east line of the location of the Old Colony Railroad; thence deflecting to the south four degrees fifty-one minutes ($4^{\circ} 51'$) and in a straight line five hundred nineteen and fourteen hundredths (519.14) feet to a point in the west shore of Fish Island; thence deflecting to the north one degree six minutes ($1^{\circ} 6'$) and in a straight line four hundred forty-seven and ninety-six hundredths (447.96) feet to the east face of the parapet of the present masonry abutment on the east shore of Fish Island; thence southerly across the bridge in the line of the face of said abutment seventy (70) feet; thence the southerly line runs westerly in a straight line parallel to and seventy (70) feet distant from the above-described north line, four hundred forty-eight and sixty-three hundredths (448.63) feet; thence deflecting to the north one degree six minutes ($1^{\circ} 6'$) and in a straight line parallel to and seventy (70) feet distant from said north line, five hundred sixteen and eighty-five hundredths (516.85) feet; thence deflecting to the south four degrees fifty-one minutes ($4^{\circ} 51'$) and in a straight line parallel to and seventy (70) feet distant from the above-described north line, one hundred forty-nine and ninety-four hundredths (149.94) feet to a point at right angles to boundstone number one; thence continuing in the same line eighty-four and eighty-six hundredths (84.86) feet to a point in the north line of Middle Street; thence westerly in the north

line of Middle Street one hundred seventy-nine and four hundredths (179.04) feet to the east line of Water Street; thence northerly in the east line of Water Street seventy (70) feet to the point of beginning.

So much of the above described location as lies east of boundstone "number one," aforesaid, being in exact conformity to the location as described by the said decree of the county commissioners, and all the metes and bounds thereof being the same as established by said decree, that part of said location lying west of said boundstone "number one" shall be taken and laid out by the city of New Bedford, under the provisions of chapter 439 of the Acts of 1900.

IV. We prescribe the grades at which the bridge and the approaches thereto shall be constructed to be as follows, to wit: the grade of the surface of the pavement on the middle line thereof shall begin at the New Bedford approach on the east line of Water Street at an elevation of ten and ninety-four hundredths (10.94) feet above the New Bedford city base; thence the grade runs by an ascending grade easterly not exceeding three (3) feet per one hundred (100) feet for three hundred seventy-eight and twenty-eight hundredths (378.28) feet to elevation twenty-two and three tenths (22.3) feet; thence in a vertical curve whose highest elevation is twenty-two and thirty-five hundredths (22.35) feet, a distance of eleven and seventy-five hundredths (11.75) feet to elevation twenty-two and three tenths (22.3) feet; thence by a descending grade of three (3) feet per one hundred (100) feet, ten (10) feet to elevation twenty-two (22) feet; thence by a descending grade of two and twenty-one hundredths (2.21) feet per one hundred (100) feet, four hundred seventy-nine and fifty-six hundredths (479.56) feet to elevation eleven and four tenths (11.4) feet; thence by a vertical curve a distance of eighty (80) feet to elevation ten and seventy-seven hundredths (10.77) feet on the west shore of Fish Island, which is the elevation established by the decree of the county commissioners dated May 23, 1898, as the grade of the bridge at this point; thence by the grade established by said decree of May 23, 1898, which is an ascending grade of six hundred sixty-nine thousandths (.669) of a foot per one hundred (100) feet, to elevation thirteen and five tenths (13.5) feet at the face of the parapet of the present abutment on the east side of Fish Island. The grade of the northerly and southerly curbs of said approaches and bridge are the same as above described for the surface of the pavement at the middle line of said approaches and bridge, except where it may be necessary to modify them in order that the curbs may be at the same elevation on opposite sides of the roadway. The grade of

the top of the coping of retaining walls and the top of the fascia of metal work is three (3) inches above the grade of the curbs.

The grade of that portion of the surface of the ground within the lines of the bridge location and beneath the metal work of the overhead bridge, from the abutment near the west line of Front Street to the abutment on the New Bedford shore, shall be as follows: beginning at the east face of said abutment near the west line of Front Street at an elevation of five (5) feet above said city base, thence easterly by a descending grade to elevation four (4) feet at the west line of the location of the Old Colony Railroad, which is the present elevation of the tracks of said railroad; thence across said location at a level grade; thence easterly from elevation four (4) feet at the east line of said location by an ascending grade to an elevation of five (5) feet at the west side of the New Bedford shore abutment.

The location and grades of said bridge and approaches are shown on a plan verified by the signatures of the joint Board, entitled "Location and grades of the New Bedford and Fairhaven bridge."

V. We prescribe that said highway, bridge and approaches as above described shall be constructed within the location and at the grades above described in the manner following:—

First.—That portion thereof from the east line of Water Street easterly for a distance of one hundred eighty-four and thirty-one hundredths (184.31) feet, measured on the centre line of said location, shall have masonry retaining walls on the north and south lines and a masonry abutment at the easterly end, the space within said walls and abutment to be filled solid with suitable filling.

Second.—That portion from the abutment just described to an abutment forty (40) feet west of the west shore of Fish Island shall consist of a bridge or metal superstructure of thirteen (13) deck spans of steel plate girders resting on three (3) masonry piers, three (3) masonry abutments and thirty-two (32) steel posts. That portion thereof over the location and tracks of the Old Colony Railroad Company shall be constructed so as to provide a clear height of sixteen (16) feet from the top of rails of said tracks to the lowest portion of the steel work above said tracks for a width of not less than twenty-five (25) feet. The clear distance between the steel posts supporting the metal span over said location and tracks shall be not less than thirty (30) feet.

Third.—That portion from an abutment forty (40) feet west of the west shore of Fish Island to the present abutment on the east shore of Fish Island shall have masonry retaining walls on the north and south lines; the space within said walls and abut-

ments to be filled with suitable filling. The roadway for the entire structure from the east line of Water Street to the east side of Fish Island shall not exceed fifty-four (54) feet in width, and shall be paved with vitrified paving brick on a concrete base, and curbed with granite on the solid fill sections and with steel on the metal work. There shall be a sidewalk on each side of the roadway not exceeding eight (8) feet in width, with a cement concrete surface commonly known as "granolithic." There shall be an iron railing of suitable design on both sides of the bridge, and approaches set on top of retaining walls and outer fascia girders of metal work.

Fourth. — That portion of the present surface beneath the metal structure within said location from the abutment near the west line of Front Street to the west line of the location of the Old Colony Railroad shall be paved with granite blocks for a width of forty-seven (47) feet, with tar concrete sidewalks and granite curbing. That portion of the surface beneath the metal structure within said location from the east line of the location of the Old Colony Railroad to the New Bedford abutment shall be graded with coarse gravel to the grades described.

Details of construction of said bridge and approaches are shown on nine plans thereof, numbered 1, 2, 3, 4, 5, 6, 7, 8 and 9, and verified by the signatures of the joint Board, dated Jan. 25, 1901, and made a part of this decree.

VI. We prescribe that the highway, bridge and the approaches and ways leading thereto and the ways underneath the same as hereinbefore set forth shall be constructed and completed as to location, grades and manner, in strict compliance with all the requirements herein and as set forth in detail in the plans and specifications aforesaid adopted and approved by this joint Board, and made part hereof; and that all the same, together with this order, forthwith shall be filed in the registry of deeds for the county of Bristol, southern district, by said city of New Bedford, all in accordance with the provisions of chapter 439 of the Acts of 1900.

JAMES F. JACKSON,
GEORGE W. BISHOP,
HERSEY B. GOODWIN,

Board of Railroad Commissioners.

WOODWARD EMERY,
CLINTON WHITE,
CHAS. C. DOTEN,

Board of Harbor and Land Commissioners.

On January 25 the joint Board, after considering four proposals for the foundation, masonry and roadway, and eleven proposals for the metal work for the completion of the bridge and highway between the east line of Water Street and the east side of Fish Island, submitted by the mayor of New Bedford as received by his city in response to advertisements, approved the action of the city in passing the following votes :—

Voted, That the joint Board of Railroad Commissioners and Harbor and Land Commissioners, acting under the provisions of chapter 439 of the Acts of the year 1900, having listened to the report of a committee of the city council of the city of New Bedford, to whom was referred the question of the approval of the contract between the city of New Bedford and the American Bridge Company for furnishing and erecting the metal work for the completion of the New Bedford and Fairhaven bridge for the sum of \$94,540, presented to said joint Board on Jan. 25, 1901, by the mayor of the city of New Bedford, do hereby approve the action of said committee in recommending said city to execute the contract aforesaid with the American Bridge Company, and hereby approve the acceptance of said bid by said city.

Voted, That the joint Board of Railroad Commissioners and Harbor and Land Commissioners, acting under the provisions of chapter 439 of the Acts of the year 1900, having listened to the report of a committee of the city council of the city of New Bedford, to whom was referred the question of the approval of the contract between the city of New Bedford and Miller & Ellis, for the sum of \$152,865, for the foundation, masonry and roadway construction of the New Bedford and Fairhaven bridge, presented to said joint Board on Jan. 25, 1901, by the mayor of the city of New Bedford, do hereby approve the action of said committee in recommending said city to execute the contract aforesaid with Miller & Ellis, and hereby approve the acceptance of said bid by said city.

On February 7 the joint Board approved the contracts executed in pursuance of the foregoing, then submitted, and also the surety for the performance thereof, as appears by the following votes and endorsements :—

It was unanimously *Voted*, That the joint Board established under the provisions of chapter 439 of the Acts of 1900 hereby approves the contract and specifications for the construction of

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foundations, retaining walls, piers, abutments, roadway, pavements, sidewalks and other fixtures, required for the construction of the New Bedford and Fairhaven bridge, from the east line of Water Street to the east side of Fish Island, exclusive of the "metal work," dated Feb. 4, 1901, and executed by and between the city of New Bedford and William L. Miller & William H. Ellis, for the sum of \$152,865; also bond in the sum of \$38,217, annexed to said contract.

It was unanimously *Voted*, That the joint Board established under the provisions of chapter 439 of the Acts of 1900 hereby approves the contract for furnishing and erecting the metal work required in the construction of the New Bedford and Fairhaven bridge from the east line of Water Street to the east side of Fish Island, dated Feb. 4, 1901, and executed by and between the city of New Bedford and the American Bridge Company for the sum of \$94,540; also bond in the sum of \$23,635, annexed to said contract.

The following endorsement was made on each of the said contracts : —

COMMONWEALTH OF MASSACHUSETTS.

SUFFOLK, ss.

At a meeting of the joint Board of Railroad Commissioners and Harbor and Land Commissioners, held under the provisions of chapter 439 of the Acts of 1900, at Room 130, State House, Boston, on Thursday, Feb. 7, 1901, all the members being present, it was unanimously voted to approve the within contract and bond.

FREDERICK N. WALES,
Clerk of the joint Board.

At a subsequent meeting of the joint Board, the appointment of William F. Williams to be chief engineer of the New Bedford and Fairhaven bridge, at a stated salary, was approved, as was also his charge for services relating to the bridge up to Jan. 1, 1901.

On June 5 the joint Board met, and the following votes were passed : —

Voted, That the letter of William F. Williams, chief engineer of the New Bedford and Fairhaven bridge, dated May 22, 1901, and addressed to Miller & Ellis, the contractors, ordering extra work upon said bridge to the amount of \$1,065.35, is hereby approved.

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Voted, That the acceptance by the city of New Bedford, on May 21, 1901, of the proposal to said city made through Chambers & Hone of New York, of the Pittsburgh Testing Laboratory, Limited, for the inspection of the mill and shop work on the metal work required in building the New Bedford and Fairhaven bridge, under chapter 439 of the Acts of 1900, at a price of 30 cents per net ton of 2,000 pounds for mill inspection and 35 cents per ton for shop inspection, be and hereby is approved.

On November 1 the joint Board met for the purpose of considering the propriety of extra work in the construction of the abutments and piers of the water section; and, after a full hearing and careful investigation, unanimously

Voted, That the letter of William F. Williams, chief engineer of the New Bedford and Fairhaven bridge, dated Sept. 1, 1901, to Miller & Ellis, the contractors, ordering extra work upon said bridge to the amount of \$4,208, and approved by the mayor of the city of New Bedford, is hereby approved.

CAPE COD CANAL.

On Dec. 6, 1900, the Board gave a hearing relative to approval of plans of location and construction of a canal from Buzzards Bay to Barnstable Bay, by the Boston, Cape Cod & New York Canal Company, which plans had been filed Sept. 28, 1899.

On Jan. 16, 1901, the joint Board met at the request of counsel for the canal company, who submitted the following forms: (1) advertisement for bids; (2) information for bidders; (3) proposals; (4) contract; (5) specifications for jetties; (6) specifications for excavation; (7) specifications for drawbridges; (8) mortgage, — and asked the Board to approve them.

On January 17 the Board received a petition from the company for approval of plans for building structures at the entrance to the canal in Barnstable Bay, issued an order of notice, and on January 22 heard the parties interested. At the close of the hearing the matter was taken under consideration, and subsequently it was voted to issue a license in accordance with the petition upon the filing of certain plans; which, however, have not as yet been filed.

On January 23 the Board met with the Railroad Commis-

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sioners as a joint Board, and again listened to the counsel for the canal company relative to the form of documents theretofore filed; but it was obviously unsuitable for the joint Board to be asked to take action before the plans for the construction of the canal had been adopted.

On February 5 the following letter was sent to the Attorney-General:—

FEB. 5, 1901.

Hon. HOSEA M. KNOWLTON, *Attorney-General of the Commonwealth, State House, Boston*

SIR:—One or two questions have arisen on the construction of chapter 448, Acts of 1899, and the Board would like your advice as to the correct interpretation thereof.

Section 4 requires the Boston, Cape Cod & New York Canal Company to “file with the Harbor and Land Commissioners a plan of the proposed location and a plan of the proposed construction thereof,” which has been done within the time required; and then says: “The plan so approved or modified, being accepted by said company, shall be deemed to be the plan of the location and construction of said canal, and said company shall be authorized to construct its canal in accordance therewith.” Later, in section 6, the statute says: “Said canal company shall construct its canal with such structures and appliances for its protection and use as said joint Board may order, together with such bridge or bridges, tunnel or tunnels, ferries and changes of highways, under the supervision of said joint Board, as shall be in accordance with plans approved by them and in conformity with such orders as they may make.”

The question upon which advice is desired is: Should this Board, under section 4, approve a plan of construction which did not include a lock, or locks, or gates, would it be in the power of the joint Board, under section 6, to order such structures to be built?

Yours respectfully,

WOODWARD EMERY,
Chairman.

On February 12 the following opinion was received from the Attorney-General:—

BOSTON, Feb. 11, 1901.

Hon. WOODWARD EMERY, *Chairman, Harbor and Land Commission, Boston, Mass.*

DEAR SIR:—The charter of the Cape Cod Canal, Statutes of 1899, chapter 448, provides, in section 4, that the corporation shall file with your Board “a plan of the proposed location and a

plan of the proposed construction thereof." It is the duty of the Board thereupon to hear the parties, require such modification, if any, as it may desire, and to approve the plans as filed or as modified.

Section 6 provides that the joint Board of Harbor and Land Commissioners and the Railroad Commissioners shall "determine at what point or points the railroad of the Old Colony Railroad Company shall cross said canal by a drawbridge or bridges, or by a tunnel or tunnels constructed under said canal." The section further provides that the canal company shall construct its canal "with such structures and appliances for its protection and use as said joint Board may order, together with such bridge or bridges, tunnel or tunnels, ferries and changes of highways, under the supervision of said joint Board, as shall be in accordance with the plans approved by them and in conformity with such orders as they may make."

The precise question submitted by your letter of February 5 is as follows: "Should this Board, under section 4, approve a plan of construction which did not include a lock, or locks, or gates, would it be in the power of the joint Board, under section 6, to order such structures to be built?"

I very much doubt whether your Board has the right to my opinion upon the question submitted. It is rather for the joint Board, if a situation arises before that Board which will make it material. But it may not be amiss for me to submit my views as to the duty of your Board under section 4, above quoted. It imposes, in my opinion, upon your Board the duty of determining in what manner the canal shall be constructed. This includes all questions relating to locks, tide gates and such other structures. You are to have in view the use of the canal for purposes of navigation, and to determine what method of construction will be the safest and most convenient in view of all the facts and probabilities, including the probable rate of tide in the canal, and how far its current may make navigation dangerous if unrestrained by structures intended to prevent such movement.

You have no means of knowing, of course, whether the joint Board will order the crossing in question to be effected by a tunnel or a bridge; but I assume that it is not unreasonable for you to anticipate that bridges, either for the railroad or for highways, will be necessary. In all events, the question of such probability is before you, and it is your duty to order the construction of the canal in such manner as will provide for all these circumstances and probabilities. The determination, therefore, of the question of locks and gates is confided to the discretion of your Board.

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The obvious purpose of section 6 is to submit to the joint Board all questions concerning the crossing of the canal by the railroad company. These questions are submitted to the joint Board rather than to your Board, for the reason that they involve on the one hand the considerations affecting railroad transportation, and navigation on the other.

The precise question whether the joint Board will have jurisdiction to order the construction of locks, in case you shall have approved plans which do not call for such structures, is one which does not concern, in my judgment, your duty under section 4, and which may well be determined when, if ever, it arises.

Yours very truly,

HOSEA M. KNOWLTON,
Attorney-General.

On February 26 the Board, after various and sundry conferences and consultations with the engineers both of the Board and of the company, and after hearing its counsel with reference to requiring a lock in the canal, passed the following votes in regard to plans and modifications thereon :—

Voted, That the plans filed with the Board of Harbor and Land Commissioners, Sept. 28, 1899, by the Boston, Cape Cod & New York Canal Company, under section 4 of chapter 448, Acts of 1899, are, in the public interest, after public notice and hearing, by virtue of the provisions of said act, hereby required to be modified as follows, to wit :—

MODIFICATIONS REQUIRED BY THE BOARD OF HARBOR AND LAND COMMISSIONERS IN THE PLANS SUBMITTED BY THE BOSTON, CAPE COD & NEW YORK CANAL COMPANY.

Location Plan.

The plan of location should show the exact situation of certain highways and bridges which now exist on the location of the canal, not shown on the plans. The shore lines and some small details at the westerly end of the canal should be altered to conform to the present conditions. The location of the westerly end of the canal shall be changed and delineated on the plan so as to conform to the plan hereto annexed, which is in substantial accordance with the statement of the engineer of the canal, as made at the hearing. In addition to the bearings written along the centre line of the canal, an arrow showing the meridian should be placed on each sheet. All to be to the satisfaction of the Board, so that the location may be sufficiently accurate for identification.

Construction Plans.

1. The plans must show the entire wetted perimeter throughout the length of the canal protected from erosion by stone or some similar indestructible material, except where the material through which the canal is excavated is of such a nature as not to be liable to erosion by the currents which are expected to flow through it.

From about 3 feet below mean low water to about 3 feet above mean high water the protective covering on the banks must be sufficient to prevent erosion from the waves created by passing vessels.

Profile.

2. The profile along the centre line of the proposed canal must, in addition to the elevations of the present surface of the ground and of the bottom of the canal, exhibit, so far as is known, the kind, location and extent of the various classes of material through which the canal is to be built.

All the elevations, so far as is practicable, must be marked on the plan in figures.

The kinds of material indicated must be described on the plan as accurately as may be in a few words.

Structural Plans.

3. One plan must show the centre line of the canal with the various bottom widths and the locations where they occur, including four meeting places for passing vessels, to be located at or near stations 112-190-328 + 50 and 380 on the plans heretofore filed. At these stations the canal to be not less than 300 feet wide on the bottom, this width to be gradually reduced on both sides of said stations, until at a distance of from 1,600 to 1,800 feet it reaches the standard bottom width of the canal at that point. It must also show the location of the various cross-sections described below.

Other plans must show enough cross-sections in detail at various points throughout the canal wherever material variations occur either in dimensions or method of construction, with verbal description where necessary.

The dimensions of the various parts must be placed on the plan in figures.

In General.

All information necessary to ascertain how and where the canal is to be constructed, without the aid of other specifications, must be placed upon the plans. The plans should be in sheets of a standard size, so that they may be bound in two atlases. The

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detail upon the various plans must be sufficient to satisfy the Board.

A title page should be added to each atlas, stating what the plans are, by whom filed, scale, date and all necessary explanatory notes, to be identified by the signature of the engineers or some officer of the canal company.

The question of locks is one relating to structures and appliances for the protection and use of the canal, and consequently must be passed upon by the joint Board, under section 6, chapter 448, Acts of 1899.

A copy of the foregoing was forwarded to the Boston, Cape Cod & New York Canal Company, to which the following reply was received : —

Boston, Feb. 27, 1901.

The Board of Harbor and Land Commissioners, State House, Boston, Mass.

GENTLEMEN : — We beg to acknowledge the receipt of a copy of the votes of the Board, passed on the 26th inst., and forwarded us by the clerk of the Board, pursuant to your resolution, and in part entitled, “ Modifications required by the Board of Harbor and Land Commissioners in the plans submitted by the Boston, Cape Cod & New York Canal Company.”

We have submitted the same to the engineer of the company for examination, requiring a reply from him to certain questions which are fully set forth in his letter, a copy of which we have the honor to enclose herewith.

In view thereof, we believe that the modifications required are acceptable to the canal company, and the same will be prepared as rapidly as possible.

Respectfully,
BOSTON, CAPE COD & NEW YORK CANAL COMPANY,
By WALTER CLIFFORD,
Clerk.

FEB. 28, 1901.

Boston, Cape Cod & New York Canal Company, 301 Tremont Building, Boston, Mass.

GENTLEMEN : — Replying to the questions referred to me by you, — “ First, are the modifications required by the Board of Harbor and Land Commissioners to be made by the canal company in its plans, modifications which will increase the efficiency and availability of the canal, with reasonable regard to economy in construction? Second, how long will it take to prepare modified

plans in accordance with the requirements of the Board?"—I submit the following:—

Referring to the communication from the Board, dated the twenty-sixth day of February, 1901, I am of the opinion that the modifications required are to the best interests of the canal, for they will tend to maintain its permanency and facilitate its operation.

Apart from mere questions of detail in the modified plans, the substantial recommendations are: (a) The change of the line at the Buzzard's Bay end of the canal, which I have already recommended to the company. (b) The widening of the canal at the points where it is crossed by the bridges, which I have equally commended. It seems to me that this last modification is a wise one, as by such widening the velocity of the current at those points will be about halved, with a tendency to reduce by irregularity of sections the velocity throughout the canal. (c) The modifications requiring that the plans show the entire wetted perimeter throughout the length of the canal protected from erosion, by stone or other similar indestructible material, *except* where the material through which the canal is excavated is of such nature, in part or in whole, as not to be liable to erosion by the currents which are expected to flow through it. This requirement is entirely proper in principle, although there might be some question as to where and to what extent this protection is necessary. From my interview with Mr. Hodgdon, the engineer of the Board, I infer that the Board intends this to be treated from a practical standpoint, and does not intend that we shall provide for work which would be of doubtful utility, and can be done later if found necessary. Lastly, (d) as to wave protection,—the only additional modification that I would suggest is that where needed it be carried 5 feet below and above mean low and high water, instead of 3 feet, as required by the Board.

Referring to your second question, it may take some time to prepare the modified plans, as required by the commissioners. I find, however, that we have on hand sufficient blue-prints of plans made from time to time to enable us, with some slight additions and changes, to furnish the Board with provisional modified plans, sufficient for all present purposes.

Respectfully submitted,

A. L. RIVES,
Chief Engineer.

On March 14 the joint Board met, and it was decided to ask the opinion of the Attorney-General upon certain legal questions submitted in the following letter:—

MARCH 14, 1901.

Hon. HOSEA M. KNOWLTON, *Attorney-General, Boston, Mass.*

DEAR SIR: — The joint Board of Railroad and Harbor and Land Commissioners met to-day to take up their duties under the recent statutes relating to the construction of a canal between Buzzard's Bay and Barnstable Bay.

At the outset we find a legal problem which we desire to submit to you.

The Board of Harbor and Land Commissioners *having approved plans* for the construction of this canal without having determined the necessity of locks, does the joint Board have jurisdiction over that question, under the provisions of section 6, chapter 448, Acts of 1899, upon the theory that it should consider locks as a structure or appliance required for the protection and use of the canal?

It has occurred to us that even although, as you have decided, the Board of Harbor and Land Commissioners had the right to pass upon the question of locks, nevertheless, that Board not having passed upon it, and having approved plans without reference to locks, the joint Board ought to take up that matter, upon the theory that the lock is a structure or appliance necessary for the protection and use of the canal.

Before proceeding, we would like to know what your views are upon this point, in view of the fact that an opinion has already been rendered which might seem to preclude the joint Board from passing upon this question.

Yours very truly,

JAS. F. JACKSON,
Chairman, Joint Board.

On April 11 the joint Board met in conference for the purpose of reading the reply of the Attorney-General, which is as follows: —

Boston, April 6, 1901.

Hon. JAMES F. JACKSON, *Chairman, Board of Railroad Commissioners, Beacon Street, Boston, Mass.*

DEAR SIR: — Your letter of March 14 states that the plans of the Boston, Cape Cod & New York Canal Company have been approved by the Board of Harbor and Land Commissioners, in accordance with the provisions of the charter of the company (Statutes of 1899, chapter 448, section 4), and are now before the joint Board of Harbor and Land Commissioners and the Railroad Commissioners, for action by the Board under the provisions of section 6 of the same statute. Your letter further states that the Board of Harbor and Land Commissioners approved the plans

"without having determined the necessity of locks," and requires the opinion of the Attorney-General upon the question whether, in view of that fact, the joint Board has jurisdiction of the question of locks.

The jurisdiction of the joint Board is, in my judgment, in no way dependent upon the action of the Board of Harbor and Land Commissioners. The charter in separate sections (4 and 6) clearly points out the duties devolving upon each Board, and the authority and responsibility of each Board is to be found in those provisions. Yours is not a board of appellate but rather of original jurisdiction.

In a letter to the Board of Harbor and Land Commissioners, dated Feb. 11, 1901, I pointed out what appeared to me to be the duties of that Board in these words: "You are to have in view the use of the canal for purposes of navigation, and to determine what method of construction will be the safest and most convenient in view of all the facts and probabilities, including the probable rate of tide in the canal, and how far its current may make navigation dangerous if unrestrained by structures intended to prevent such movement."

To these views, after the re-examination made necessary by the request of your Board for an opinion, I still adhere. The scheme of the statute, although not always expressed in the clearest terms, appears to me to be as follows: the company chartered must, within four months, file with the Harbor and Land Commissioners a plan of the proposed location and "a plan of the proposed construction thereof." I see no reason to doubt that the word "construction" necessarily includes and was intended by the Legislature to include all things appertaining to the construction of the canal, including the question of locks, which, I take it, is one of the most important questions touching the construction of a canal.

Before filing such plans, the company must deposit with the Treasurer of the Commonwealth the sum of \$200,000, to be held as security for the payment of damages occasioned by the taking of land. If the plans are not approved by the Board of Harbor and Land Commissioners, or if the modifications ordered by them are not acceptable to the company, it may withdraw its deposit and forfeit its rights under the charter (section 23). But if, on the other hand, it is content with the plans of location and construction as finally approved by the Harbor and Land Commissioners, the deposit cannot be withdrawn, and, whatever future action the company may take, its deposit must remain in the treasury.

It is apparent, therefore, that the question of the approval of the plans by the Harbor and Land Commissioners is one of vital

importance to the company. If, for example, the plans as finally adopted by that Board require a method of construction which, in the opinion of the company, is too expensive to be profitable, the opportunity is given it to abandon its project and receive its money back. It has a right, therefore, to know, before going further, just what is required of it in the way of location and construction.

Furthermore, the jurisdiction of the question of location and construction is confided to a Board which is presumed to be especially familiar with that subject, and which can adequately represent the interests of the Commonwealth and of the public. It is the duty, therefore, of the Harbor and Land Commissioners to settle all questions of construction, with one exception; that exception is the matter of the crossing of the canal by the railroad company. The jurisdiction of this question is given to a joint Board, consisting of the Railroad Commissioners on the one hand and the Harbor and Land Commissioners on the other; it being presumed that conflicting questions between the railroad and the canal are properly submitted to such a tribunal. Section 6, therefore, provides that such joint Board shall "determine at what point or points the railroad of the Old Colony Railroad Company shall cross said canal by a drawbridge or bridges, or by a tunnel or tunnels constructed under said canal." Such joint Board, after due notice, "shall determine said questions, and the decision of a majority of said joint Board shall be final. Said canal company shall construct its canal with such structures and appliances for its protection and use as said joint Board may order, together with such bridge or bridges, tunnel or tunnels, ferries and changes of highways, under the supervision of said joint Board, as shall be in accordance with plans approved by them."

All questions, therefore, which may arise concerning the manner of the crossing of the canal by the railroad company, and they only, are within the jurisdiction of the joint Board.

The determination of these questions may incidentally involve the further question whether, for the protection of the canal on the one hand or the railroad on the other, locks may be required; and it is in that aspect only that your Board has to determine any question concerning locks. Questions of navigation, or the velocity of the tide, and all other matters incidental to the question of the necessity of locks, are presumed to have been determined by the Board of Harbor and Land Commissioners before the plans come to your Board.

I do not forget that the words above quoted, "said canal company shall construct its canal with such structures and appliances

for its protection and use as said joint Board may order," taken alone, might seem to give original jurisdiction to your Board of the question of locks. But I cannot believe the Legislature intended a divided responsibility. As I have already said, each Board has its own duties in the matter. Your Board is concerned only with the crossing of the railroad; and the words "structures and appliances" must be taken, in connection with the rest of the section, to refer only to the matters to which the section as a whole relates. This is still more apparent from the fact that, after action by the Board of Harbor and Land Commissioners, the company, having elected to proceed, is not at liberty to withdraw and to receive back its deposit. It is not to be presumed that the Legislature, having once given an opportunity to the company to take back its deposit and withdraw from the enterprise, if the conditions as to construction imposed by the Board having jurisdiction of the matter are too onerous, should authorize another board to reimpose the same conditions, when the time for withdrawal has elapsed.

I am of the opinion, therefore, that the question of locks is not before your Board, excepting so far as the necessity of them may arise in consequence of the method of crossing by the railroad company determined upon by the Board may require structures for the protection of the canal and of the railroad company.

Very respectfully,

HOSEA M. KNOWLTON,
Attorney-General.

On April 15 the following letter was sent to the counsel for the canal company:—

Boston, April 12, 1901.

HON. WILLIAM M. BUTLER, *Counsel, Boston, Cape Cod & New York Canal Company.*

DEAR SIR:—The members of the joint Board of Railroad and Harbor and Land Commissioners met yesterday, to consider the opinion of the Attorney-General, defining the duties of the Board.

Following out this interpretation of the law, it seems clear that the joint Board has no jurisdiction until after an approval of plans for the construction of the canal by the Board of Harbor and Land Commissioners, and until application has been made by the canal company, under section 6, chapter 448, Acts of 1899. As soon as such application is made, the joint Board will, after due notice to the parties, proceed to determine the question of structures and appliances in accordance with the provisions of the above-named section. If the plans approved by the Board of Harbor and Land Commissioners shall provide for a canal without locks, the joint Board may be called upon to consider the subject of

locks as structures or appliances, within the meaning of this section of the statute.

We understand that the canal company has not as yet adopted on its plans the modifications suggested by the Board of Harbor and Land Commissioners, and that said plans have not been laid before that Board for final approval.

Very truly yours,

JAMES F. JACKSON,
Chairman.

On May 9 a petition of the company was filed with the joint Board for authority to issue capital stock to the amount of \$360,000, and bonds to a like amount, under authority of chapter 476 of the Acts of 1900. The following is a copy of the petition :—

COMMONWEALTH OF MASSACHUSETTS.

To the Board of Railroad Commissioners and Harbor and Land Commissioners, sitting as a Joint Board.

RESPECTFULLY REPRESENTS the Boston, Cape Cod & New York Canal Company, a corporation organized under chapter 448 of the Acts of 1899 and chapter 476 of the Acts of 1900, as follows :—

First.—This Board, sitting as a joint Board, by order dated June 26, 1899, authorized the issue of stock of your petitioner to the amount of one hundred forty thousand dollars (\$140,000), and bonds to a like amount, as soon as a deposit of two hundred thousand dollars (\$200,000) should be made by your petitioner with the Treasurer of the Commonwealth, in accordance with the provisions of section 23 of chapter 448 of the Acts of 1899; and the issue in like manner of such further amounts of stock and bonds, not to exceed in the aggregate (including the issues above mentioned) six million dollars (\$6,000,000) each, as from time to time on the application of your petitioner should have been approved and certified by said joint Board in the manner provided in chapter 462 of the Acts of 1894, as reasonably requisite to enable your petitioner promptly and in good faith to carry out the purposes set forth and specified in said chapter 448 of 1899; *provided*, that the total amount of bonds so approved, certified and issued should at no time exceed the total amount of capital stock then actually paid in and outstanding as aforesaid.

Second.—Prior to said order, and on the tenth day of June, 1899, your petitioner entered into a contract with the Cape Construction Company, a corporation duly organized under the laws of the State of New Jersey, by the terms whereof said Cape Construction Company agreed, among other things, to deposit for and on

account of your petitioner the sum of two hundred thousand dollars (\$200,000) with the Treasurer of the Commonwealth of Massachusetts, the sum of twenty-five thousand dollars (\$25,000) with the treasurer of the county of Barnstable, and the sum of five hundred dollars (\$500) each to the towns of Bourne and Sandwich, within the times required by, and in accordance with, the provisions of said chapter 448 of the Acts of 1899 for the making of such payments and deposits; and to proceed with all convenient speed to survey and lay out the location of the canal described in the charter of your petitioner, and file within four (4) months from the first day of June with the Harbor and Land Commissioners a plan of the proposed location and a plan of the proposed construction of said canal; and your petitioner agreed that on the deposit and payment of the several sums required by its charter to be paid and deposited in accordance with the provisions of said charter with the Treasurer of the Commonwealth, the treasurer of the county of Barnstable and to the towns of Sandwich and Bourne, being in all the sum of two hundred twenty-six thousand dollars (\$226,000), and upon the filing with the Board of Harbor and Land Commissioners of plans of the proposed location and construction of said canal, with the breakwaters, docks, wharves and other structures necessary for the convenient use of said canal in a form satisfactory to your petitioner, your petitioner would, as soon as might be thereafter, and upon request of said Cape Construction Company, forthwith pay and deliver or cause to be paid and delivered to said construction company shares of the capital stock and bonds of your petitioner of the par value of five hundred thousand dollars (\$500,000) of each such stock and bonds to be issued pursuant to its charter.

Third.—Under the aforesaid order there have been certified and issued to your petitioner stock to the amount of one hundred forty thousand dollars (\$140,000), and bonds to a like amount.

Fourth.—Said Cape Construction Company has made all deposits and payments and performed all acts necessary under its contract with your petitioner above mentioned to entitle it to the payment and delivery to it by your petitioner of shares of the capital stock and bonds of your petitioner to the par value of five hundred thousand dollars (\$500,000) of each such stock and bonds to be issued pursuant to its charter, except the deposit of twenty-five thousand dollars (\$25,000) with the treasurer of Barnstable County, and that it stands ready to deposit said amount; and upon such deposit your petitioner will be liable to said Cape Construction Company for the payment and delivery of said stock and bonds, but is unable to meet said obligation until the certificate

and issue to it of stock to the amount of three hundred sixty thousand dollars (\$360,000), and bonds to a like amount, shall be approved and certified by this Board, sitting as a joint Board; and that, in order to enable your petitioner to comply with the other terms of said contract to be subsequently performed, it will be necessary that the further amounts of said stock and bonds mentioned in said contract be issued and certified as provided by said contract.

WHEREFORE, your petitioner prays that this joint Board will approve and certify to the Old Colony Trust Company as reasonably requisite to enable your petitioner to promptly and in good faith carry out the purposes set forth and specified in said chapter 448 of the Acts of 1899, the immediate issue and certification of capital stock of your petitioner to the amount of three hundred sixty thousand dollars (\$360,000), and of bonds to a like amount and the further issue and certification of stock and bonds to the amounts set forth in said contract, from time to time, on certificate of this Board that the work required under said contract for the delivery of such stock and bonds has been completed.

BOSTON, CAPE COD & NEW YORK CANAL COMPANY,

By CHARLES C. DODGE,

President.

On May 23 the joint Board met, and heard parties interested on the foregoing petition, and took the matter under advisement.

On July 1 the joint Board met, and signed the following order, refusing to approve an issue of stock and bonds by the canal company, as petitioned for May 9, 1901:—

PETITION OF THE BOSTON, CAPE COD & NEW YORK CANAL COMPANY FOR APPROVAL OF AN ISSUE OF STOCK AND BONDS.

After due notice to all parties interested, a public hearing was given upon this petition.

The petitioner in the early part of 1899 applied to this Board, under the provisions of chapter 448 of the Acts of 1899, for authority to issue capital stock to the amount of \$6,000,000, and bonds to the amount of \$6,000,000.

After a careful consideration of the evidence and arguments presented in support of the petition, the Board issued an order, under date of June 26, 1899, authorizing the issue of this amount of stock and bonds, in such amounts as the Board from time to time, upon evidence presented to it, should deem requisite for carrying out the lawful purposes of the company.

The order authorized an immediate issue of stock to the amount of \$140,000, and of bonds to a like amount, to provide the means for payment of certain deposits which the statute required the company to make, and for payment of expenses connected with the making of surveys and plans. The approval of the issue was made dependent upon the performance of certain conditions named in the order.

Upon the request of the petitioner for a modification of this order, the case was re-argued in the following September, and modification refused.

Since then additional legislation has been secured by the petitioner, to be found in chapter 476 of the Acts of 1900. That statute authorizes the joint Board to approve a contract or contracts for the building of the canal, by the terms of which stock and bonds may be issued in payment for labor and material; but provides that such contract or contracts shall first be open to bids, and that there shall be public advertisement for such bids. It is suggested by counsel for the petitioner that the Board has power to waive the giving of the public notice named in this statute. We cannot agree that we have this power, nor that, if we had it, we ought to exercise it. The opportunity through advertisement for bids to secure the benefits of competition are clearly an essential feature of the legislation of 1900.

The petition now before us is based, then, upon the same provisions of law that governed the action of the Board upon the former petition. Indeed, the petitioner practically admits this, but claims that conditions have materially changed. It is true that some additional steps have been taken, looking to the carrying out of the enterprise. Large expenditures have been made upon plans for the construction of the canal, and in the presentation of them to the Board of Harbor and Land Commissioners. That Board, after several hearings and a careful, expert investigation, has suggested certain modifications in the plans, and has signified that upon the adoption of such modifications the plans will be approved. There still remain, however, questions of great importance connected with the construction of works necessary to the completion of the canal. No steps have as yet been taken to bring these questions before the joint Board which is to decide them. Moreover, although full authority was given to the petitioner, under the order of 1899, to issue stock and bonds for certain specific purposes, no such issue has been made, and the requirements of the order in respect to the preliminary steps to be taken by the company have not been carried out.

At this point we are asked to approve an issue of stock and

bonds upon the basis of a contract between the Boston, Cape Cod & New York Canal Company, the petitioner, and what is known as the Cape Construction Company, executed June 10, 1899, which provides for the payment to the Construction Company of \$12,000,000 in stocks and bonds as the cost of building the canal. An approval of this petition, although it calls for the issue at present of stocks and bonds amounting to \$1,000,000 only, would be to all intents and purposes an approval of that contract; would mean that, without any presentation of evidence of the actual or estimated cost of the completed canal, the joint Board would be irrevocably committed to the possible over-capitalization of a public enterprise. All the arguments in favor of such action were exhaustively presented to this Board in connection with the petition of 1899. The circumstances under which these arguments are again urged upon our attention are substantially unchanged, and the joint Board sees no reason to depart from its former adjudication.

Whenever the company shall offer satisfactory evidence to prove that an issue of capital stock and bonds is reasonably requisite to carry out any one of the purposes recognized by the statute, the approval of this Board will be given to such issue upon conditions similar to those named in its former order.

We cannot, upon the evidence presented in support of this petition, approve the proposed issue of stock and bonds.

JAMES F. JACKSON,
GEORGE W. BISHOP,
CLINTON WHITE,
Railroad Commissioners.
WOODWARD EMERY,
CHAS. C. DOTEN,
GEO. E. SMITH,

Harbor and Land Commissioners.

Boston, July 1, 1901.

APPONAGANSETT HARBOR.

By chapter 38 of the Resolves of 1901, the Board was directed to cause a survey and estimate to be made as to the advisability and cost of improving the harbor at Apponagansett in the town of Dartmouth, by constructing a break-water at its entrance or by some other means, and to report thereon to the General Court.

The necessary survey and estimate has been made, and the report of its engineer duly considered by the Board.

The construction of a stone breakwater at the entrance to Apponagansett harbor is entirely feasible, and is unquestionably the best means of affording the desired protection. The large cost of the project would raise a question as to its advisability. A plan of the project is appended. The report of the engineer in full is as follows :—

BOSTON, Dec. 18, 1901.

To the Board of Harbor and Land Commissioners, State House, Boston.

GENTLEMEN :— In accordance with your instructions, I have had a survey and estimate made to determine the cost of improving the harbor at Apponagansett in the town of Dartmouth by constructing a breakwater at its entrance and removing some of the bowlders which obstruct the anchorage ground, pursuant to the provisions of chapter 38 of the Resolves of 1901.

The harbor is formed by a bay at the mouth of Apponagansett River in South Dartmouth, on the western shore of Buzzards Bay, about 2 miles south of New Bedford. The bay is about 3,000 feet wide at its mouth opposite Ricketson's Point, and narrows to about 1,500 feet at the bridge, 4,000 feet above, which is practically the limit of navigation. The anchorage in the bay is well protected from winds coming from all directions except the south-east, and gales from this direction often come up suddenly and are quite violent, having a rake of the whole width of Buzzards Bay for about 11 miles.

The survey covers the whole area of the bay, the topography being carried for about 1,000 feet northerly along the Buzzards Bay shore and down to the Nonquit wharf on the southerly shore of the bay. The soundings cover the whole area from the bridge down to the mouth of the bay, and extend out into the sound a sufficient distance to cover all possible locations of a proposed breakwater. The bottom of the bay is quite hard, as shown by the many rocks projecting above its surface. Ricketson's Point consists of ledge, the outer slopes of which are covered with many bowlders.

At the anchorage inside Ricketson's Point and within the line of the proposed breakwater there is a depth of not less than 12 feet of water over an area of 101 acres, and a very large part of this is over 16 feet in depth; and, if it is protected from south-easterly gales, it will afford a remarkably convenient and safe anchorage. At the present time it is much frequented by yachts from New Bedford, yacht owners preferring to keep their yachts here rather than in New Bedford harbor, where the water has become so foul as to interfere very much with keeping the yachts

clean. During the last year the New Bedford Yacht Club has erected a club house near the bridge at the head of this harbor; and, as there is an electric car line which makes frequent trips between South Dartmouth and New Bedford, it is very convenient for yachtsmen, as a yacht can get into the open bay much quicker from this point than from New Bedford harbor in the south-westerly winds which prevail in summer.

The only question seems to be as to the best location for the breakwater; and, having due regard for the cost of the work and the anchorage area to be secured, I have finally located it running in a south-westerly direction from the extreme end of Ricketson's Point, leaving the opening between the south-westerly end of the breakwater and the 12-foot curve on the Nonquit shore about 800 feet. This will protect, as before stated, an area of 101 acres, having a depth of more than 12 feet at mean low water; and, if a larger area is required in the future, it would probably be cheaper to dredge the flats at that time than to locate the breakwater farther out to sea at the present time.

During the survey our attention was called to a number of bowlders scattered in various parts of the harbor, and an effort was made to find and determine their location. A number of these bowlders were found and their position marked on the chart; but the engineers were told that there were a number of others, but they were unable to find any one who had time to go out and point out their location, and, although search was made, they were unable to find them themselves.

The cheapest effective form of breakwater which can be built in this location is one composed of granite quarry grout, having side slopes flat enough to stand the effects of the sea, the blocks on the exposed faces being large enough not to be individually rolled about by the sea to which they are exposed. I have planned this breakwater to be 10 feet wide on top, at an elevation 10 feet above mean low water; the outer face to slope at an angle of $1\frac{1}{2}$ to 1 from the top to the bottom; the back side toward the harbor to be vertical for a distance 5 feet from the top, and then slope at an angle of $1\frac{1}{2}$ to 1 to the bottom; the head at the outer end of the breakwater to be 20 feet in diameter, 10 feet above low water, with side slopes of 2 to 1 all around. This will require about 121,200 tons of stone. The estimated cost of the work is as follows:—

121,200 tons of stone, at \$1.20,	\$145,440
Removing bowlders from the harbor,	500
Engineering and contingencies,	14,500
Total,	<u>\$160,440</u>

The above estimates are for a breakwater to cover the largest possible area of anchorage ground ; but if a breakwater should be built only one-half as long, the safe anchorage for small boats and yachts would be very largely increased over what it is at the present time ; and if it is desired at any time to complete the work, in order to secure the greatest possible advantage from the breakwater, there will be no loss from taking down the work already constructed, — it will simply have to be added to.

Respectfully,

FRANK W. HODGDON,
Engineer.

HERRING RIVER.

By chapter 66 of the Resolves of 1901, the Board was directed to cause a survey and estimate to be made as to the advisability and cost of improving the entrance to Herring River in the town of Harwich, and of erecting barriers for the protection of the beach in that vicinity, in order to provide a harbor of refuge for small sailing craft and to protect the shore line, and to report thereon to the next General Court.

The necessary survey and estimates have been made, and the report of its engineer duly considered by the Board.

In order to maintain an effectual opening at the mouth of the river, it would be necessary to build two jetties, of which the western should be the longer. These may be of timber or of stone, but inasmuch as, if built of timber, they would within a few years require to be reinforced by stone, that is the material the Board would recommend to be used in construction. The jetties for the purpose of navigation alone might be built at substantially right angles to the shore ; but the drift of seaweed on this shore cannot be ignored, especially in designing a structure intended for increased comfort and accommodation to the public ; therefore the plan providing for a channel at an angle of about 45° to the shore, which is the more favorable to allowing seaweed to drift across the mouth of the opening, is to be preferred, should the Legislature see fit to make the necessary appropriation. The estimate of cost seems large in comparison with the number of possible beneficiaries of the improvement. If built at the angle proposed, there is no certainty that seaweed will not accumulate and create a nuisance, as at Witchmere. For

these two reasons the Board is unable to say affirmatively that it is advisable to make the improvement suggested.

A plan of the project is appended. The report of the engineer in full is as follows :—

Boston, Dec. 10, 1901.

To the Board of Harbor and Land Commissioners, State House, Boston.

GENTLEMEN:—In accordance with your instructions, I have made surveys and estimates to determine the advisability and cost of improving the entrance to Herring River in the town of Harwich, as authorized by chapter 66 of the Resolves of 1901. The surveys were made in the month of June, and extended for about a mile along the shore of Nantucket Sound at the mouth of the river and for about one mile up the river. The topography was mapped and soundings taken out to a depth of about 10 feet at mean low water. The river is generally about 100 feet wide between the marshes, but widening in places to 200 feet or over. The thread of the channel has a depth, where it passes through the crest of the beach, of from 3 to 4 feet at mean low water, but above this and on the outer slope of the beach it is not over 1 to 1½ feet.

The action of the sea and the current has deposited large quantities of sand in the sound opposite the mouth of the river, so that the line 3 feet below mean low water opposite the mouth is about 1,500 feet from the shore line, while half a mile on either side it is not over one-half that distance.

At the present time there is a timber fence or jetty, built of stakes and planks, on the westerly side of the outlet, which has been built by the town, with the aid of contributions from people living in the vicinity. This structure was built of such light materials that the sea has damaged it so that it has required constant repairs; and, while it has protected the entrance to a certain extent, it has not been sufficient to maintain a safe entrance into the mouth of the river.

There are two bridges crossing the river near its mouth, one about a quarter of a mile from the mouth, which is about 45 feet long and built on piles, the approach on either side being a solid causeway. The opening is so narrow that the current has scoured a deep hole near the bridge. The second bridge is located about one mile from the mouth, and is an iron truss bridge with a span of about 120 feet, the full width of the river between the marshes. Just above this bridge, previous to 1870, a dam was built to reclaim the salt meadows above and turn them into hay land, the same as was done at Green Harbor. This dam remained

for a number of years, but some time before 1880 it broke away and was wholly removed. During the time it was in existence the tidal volume of the river was very largely reduced, and, as at Green Harbor, considerable quantities of sand were driven by the sea and the tide into the lower reaches of the river.

The river drains a large territory, extending well up into Brewster, and is the outlet of a number of large ponds in that vicinity; but the fresh water flow is small compared with the tidal flow.

The general drift of the sand along the shore in this vicinity is from west to east, and the jetty already built on the westerly side of the outlet has checked this drift and built out the shore line for about 200 feet beyond the general line of the shore. This protects the beach on the easterly side of the outlet from waves coming from the south-west, but leaves it exposed to those from the south-east, which now cut away the bluffs to the east of the outlet, there being no jetty at present on the easterly side to protect the entrance. This drifting sand, being forced over into the channel faster than it could be cut away by the current, has gradually forced the channel well over to the eastward, so that it now has cut away the sand from back of the jetty, and is flowing out across the line of the inner end of the jetty. The sand thus scoured out is deposited in the sound in front of the outlet.

New works to improve the entrance should consist of a jetty on each side of the mouth of the river, one of which, at least, should extend out to a depth of 3 feet or more at mean low water. If the question were simply to make a safe entrance for boats into the mouth of the river, protected from sand drifted by the waves and current, jetties built out at right angles with the general trend of the shore would probably work best; but in this locality large quantities of seaweed are annually torn up from the bottom of the sound and thrown up on the beach during the summer months. The prevailing summer winds being from the south-west, this is driven along the beach, and would be lodged against the westerly jetty, and become a great nuisance to users of the beach for bathing and similar purposes. This seaweed can be removed only by being taken from the water and carted away, as, if it is allowed to remain, the odors coming from it are very offensive. In order to avoid this trouble, I have designed jetties extending south-easterly, making an angle of about 45° with the general trend of the shore, with the expectation that, as the seaweed is driven by the waves along the shore, it will slide along the back side of the jetty and be carried across the line of the channel and landed on the beach to the eastward, the jetties being planned so that south-westerly waves will strike not exactly at a right angle, but at such an angle

as will drive the seaweed along the jetty until it reaches its outer end. One objection to this location of the jetties is that there is some possibility that the sand may be driven by the outer end of the jetty, as it is driven along the shore by the same forces which move the seaweed; but, as the sand is moved by rolling along the beach, and does not float on the surface, as does the seaweed, I do not think that any serious trouble will occur from this cause.

If the jetties are thus located, it will be necessary to deflect the ebb current in the river practically at right angles to the course at which it approaches the beach, and the bank at this place will have to be thoroughly protected to keep it from wearing away.

The easterly jetty is planned much shorter than the westerly one, in order that the seaweed will not be caught in the flood current before it has had an opportunity to pass by the entrance. As the location of the jetties is principally on the flats, whose surface is less than 1 foot below mean low water, estimates have been made for timber jetties as well as for more permanent stone ones; the timber work to be substantially the same as that built at Osterville and Witchmere harbor, and, as at Osterville, they will have to be strengthened with stone at some future time. The width between the jetties has been fixed at 150 feet.

Owing to the limited volume of tidal water, it will be necessary to dredge the entrance channel, as the current will not be strong enough to scour it unaided, relying on the current to maintain it after it is excavated. After a study of the present channels, I have decided to recommend that the dimensions of the proposed entrance channel be as follows: 100 feet wide on the bottom, with the necessary side slopes, and 3 feet deep at mean low water. This gives a section considerably larger than that of the channel which the current now maintains through the beach; but this has to maintain itself by scouring out the sand which is constantly being driven in by the waves, while the new channel will be protected by jetties. In order to get the full benefit of the tidal flow to maintain the channel, the opening in the lower bridge across the river should be made at least double its present width.

On the westerly bank of the river at its mouth is located a large summer hotel and a considerable village of summer cottages, and on the opposite bank there are also a number of summer cottages.

I submit herewith estimates for two methods of improving the entrance: one by a channel to be located substantially at right angles with the shore of the sound, the other with the entrance channel trending to the south-east, planned to avoid the nuisance caused by the drifting seaweed. In each I have estimated the cost of the jetties built both of wood and of stone:

The cost of the first plan may be reduced by omitting 200 feet

from the outer end of the easterly jetty; and I would suggest, if this plan is adopted, that this section be omitted, as I have seen channels maintain themselves in very good condition where they were protected by jetties one of which projected a considerable distance beyond the other. If at any time in the future it is found advisable to improve the channel still further, this jetty can be extended to its full length without interfering with any portion of the work previously constructed. The estimates are as follows: —

Channel at right angles to the shore, with timber jetties: —

Dredging,	\$9,600
Jetties,	22,500
Supervision and contingencies,	3,200
	<hr/>
	\$35,300

Channel at right angles to shore, with stone jetties: —

Dredging,	\$9,600
Jetties,	44,200
Supervision and contingencies,	5,300
	<hr/>
	\$59,100

As before stated, this estimate may be reduced by shortening the eastern jetty 200 feet, as follows: —

For the wooden jetties,	\$2,700
For the stone jetties,	8,100

Channel at an angle of about 45° to the shore, with timber jetties: —

Dredging,	\$7,600
Jetties,	22,600
Supervision and contingencies,	3,000
	<hr/>
	\$33,200

Channel at an angle of about 45° to the shore, with stone jetties: —

Dredging,	\$7,600
Jetties,	41,600
Supervision and contingencies,	4,900
	<hr/>
	\$54,100

The general location of the proposed jetties is shown on the annexed plan.

Respectfully,

FRANK W. HODGDON,
Engineer.

EAST BAY.

Chapter 102 of the Resolves of 1901 reads: "That the board of harbor and land commissioners may, if in their opinion the change of conditions since the surveys and estimates authorized by chapter ninety-six of the resolves of the year eighteen hundred and ninety-nine so warrant, make such further surveys and estimates as they may deem necessary as to the advisability and cost of cutting a channel from East bay, in the town of Barnstable, to Vineyard sound, for the purpose of providing a harbor of refuge; and they shall report thereon to the next general court not later than the first day of February." Upon due consideration, the Board was not of opinion that there was any change of condition sufficient to warrant making further surveys and estimates as to the advisability and cost of cutting the proposed channel.

The estimate of the cost of the channels and protective works, as stated in the annual report of the Board for the year 1899, pages 40-43, cannot be substantially changed without diminishing the extent and character of the protective works provided in that estimate; and the Board has not been able to find any such change in conditions or in the reasons which controlled their previous opinion as to feel justified in recommending any change in the need or extent of the protective works and dredging therein suggested as necessary to properly construct and maintain the desired channel.

BASS RIVER.

By chapter 39 of the Resolves of 1901, the Board was directed to cause a survey and estimate to be made as to the advisability and cost of improving the entrance to Bass River in the towns of Dennis and Yarmouth, and to report on the same as soon as the survey and estimate were completed. This was done, and the report (House, No. 1430) made June 4, 1901, making an estimate of \$22,000 as the cost of the suggested improvements. By chapter 113 of the Resolves of the same year the Board was directed to improve the channel in accordance with the report, and an appropriation of \$22,000 was made for the purpose.

Plans and specifications were prepared for the construction

of two timber jetties, one on either side of the river mouth, and for the excavation of a channel between them, across the flats, to the depth of 4 feet at mean low water.

On November 14, after opening proposals as advertised, a contract for labor and material was made with Augustus Bellevue & Co., the lowest bidder. Work will commence early in the spring.

SCITUATE.

In pursuance of chapter 434 of the Acts of 1900, the Board made an examination of the shores and harbor of the town of Scituate, and concluded that it would be necessary to build a sea wall at the Sand Hills, so called, where the ocean broke across into the harbor in the great storm of November, 1898. Accordingly a contract was made with Taylor, Carr & Andrews, and in accordance therewith a concrete sea wall 998 feet long, with a uniform surface level and about 8 feet above the plane of mean high water, was built at a cost of \$5,408.05. The sand comes up to the level of the top of the wall on the inside.

The work was completed in the middle of December, 1900, and has withstood the heavy storms and high tides in the most satisfactory manner. It promises to afford complete protection to the harbor against any easterly or northeasterly gales.

At the request of the selectmen, the Board visited Stage House beach and the beach at the north end between Damon's Island and the Glades. The sea is undoubtedly wearing away the Third Cliff; but the protective work that would prevent the shores of the cliffs from washing would be attended with large expense, and not worthy the undertaking unless the coast for a long distance should be included. At the north end of the beach, however, after a careful examination and watching the effect of some recent storms, notably the one of Nov. 25, 1901, the Board has concluded it would be wise to expend the balance of the appropriation in building a protective wall somewhat similar to the one built to protect the harbor.

While the Board does not concur in the fear expressed by residents of Scituate that there is a liability of inundation across this beach and the marshes behind it into Cohasset

harbor, it nevertheless is of opinion that building the proposed wall would prevent the rolling back of the beach.

The apprehensions of the town were expressed to the Board through a committee, who stated that so great was their feeling about the necessity of this protective work, the cost of which would exceed the balance of the appropriation, that the town would appropriate a sufficient sum, in addition to the available balance of the appropriation, to have it carried out in such form as the Board would require it to be done. This work will presumably be commenced in the early spring.

GREEN HARBOR.

Early in the summer a survey was made of the channel at Green Harbor which was excavated the previous year. As dredged, the channel was 60 feet wide on the bottom and 5 feet deep at low water. Near the outer ends of the jetties the banks had washed down, and thus had widened, although shoaled, the channel in that location; the inner portion of the channel was found to have suffered but little change.

The anchorage basin which was excavated above the Narrows had shoaled considerably at its inner end, where the current on the ebb tide washed down quantities of sand from farther up the harbor. These changes were not unexpected, but their extent could not be anticipated.

The improvements made have renewed the interest of the fishermen, yachtsmen and others, and during the season the fishermen put a number of naphtha launches into use. The channel, even with the shoaling which has taken place at the entrance, has substantially as much water as there was on the bar previous to the construction of the dike, and is giving great satisfaction.

The extreme high tide of Nov. 18, 1901, damaged a portion of the bulkhead, built at the inner end of the western jetty to prevent the sand from blowing and drifting into the harbor. This damage has been repaired at a small expense, in a manner which will prevent a recurrence of the trouble.

The total expenditure on the harbor since the passage of chapter 469 of the Acts of 1898, authorizing its improvement, is \$65,790.47. On account of the settlement of a portion of the stone jetties, additional stone will be required to restore their original elevation.

OSTERVILLE.

In May an examination and survey was made of the channel at West Bay, Osterville, to determine what changes, if any, had taken place there. It was found that the depth of water at the entrance channel between the jetties and on the shoal at the end of the jetties had increased; and that the channel across the bay, while maintaining its depth of nearly 3 feet at mean low water throughout its length, had altered its bed somewhat, but was generally in good condition.

This harbor has been considerably used by pleasure boats during the past season. The worms have eaten the planks in some sections of the jetty to a considerable extent, and a few of them have been wholly eaten off. It was therefore determined to continue the work of strengthening the jetties by means of stone riprap, as had already been commenced, and a contract was made Sept. 17, 1901, with Eugene S. Belden of Hartford, Conn., to place 1,200 tons of stone in the jetties, at the price of \$2.47 per ton. The whole length of the timber work is now protected by stone riprap, and it is not anticipated that any further expenditure will be required on these structures for a number of years.

The cost of the work done this year is as follows:—

Stone riprap,	\$2,964 00
Surveys and supervision,	17 50
	<hr/>
	\$2,981 50

The total cost of the work is \$20,865.39.

LAKE ANTHONY.

By chapter 399 of the Acts of 1901, the Board was authorized to expend a sum not exceeding \$5,000 for dredging and other necessary work to improve the harbor at Lake Anthony, Cottage City.

In May a survey was made to determine the depth of water and character of the bottom in the harbor and its entrance. The stone jetties and entrance channel were found in good condition; a slight shoaling was found in the entrance channel about opposite the low-water mark on the beach outside of the jetties, but not, however, sufficient to reduce the navigable depth of the channel. The bottom

of the harbor proper was found to consist of a considerable depth of soft mud, which supported a luxuriant growth of grass. It was learned that in the previous season vessels anchoring there had dragged anchors during severe squalls until they grounded.

An estimate was made of the cost of excavating this mud, in order to get good holding ground; but the quantity was so large that it could not be done with the available appropriation. It was also found that the approach to the landing wharf which had been built on the Cottage City side of the harbor was too shoal for use by the larger class of boats, and it was therefore decided, after conference with the local authorities, to confine the dredging to the excavations required to give boats free access to this wharf at all times, and to place ten heavy moorings in the harbor, to which yachts and vessels could be moored securely. The necessary stones, chains and buoys were purchased, and a contract made with George H. Cavanagh, whose plant was in that vicinity, to set the moorings and do all needful dredging for the sum of \$2,500, also to remove any shoaling which had taken place in the entrance channel. The moorings were set early in the season, and the work completed in a satisfactory manner by Oct. 21, 1901. The material excavated was deposited on the adjacent shore, where, after being levelled down, it will form a smooth, steep beach, and greatly improve the shores of the lake.

At the suggestion of this Board a harbor master was appointed, who will take charge of and regulate the use of the moorings.

The cost of the work done this year is as follows:—

For moorings,	\$296 63
For setting moorings and dredging,	2,500 00
Surveys and supervision,	66 88
Total,	<u>\$2,863 51</u>

The total cost of the work is \$24,290.64.

The United States lighthouse department has placed two lights at the ends of the jetties which were built by the Commonwealth, within an area 10 feet in diameter in the centre of the head of each jetty, which by request was con-

veyed to the United States under the provisions of section 7 of chapter 1 of the Public Statutes for the purpose of erecting and maintaining these lights. The structures were erected and the lights put in operation in August. The conveyance was made after consultation with the Attorney-General, who confirmed the authority of the Board to take action in a communication, of which the following is a copy : —

BOSTON, June 25, 1901.

HON. WOODWARD EMERY, *Chairman, Board of Harbor and Land Commissioners.*

DEAR SIR : — Your letter of June 4 states that “ under the provisions of Statutes of 1898, chapter 441, and Statutes of 1899, chapter 155, the Board of Harbor and Land Commissioners has cut a channel between Lake Anthony at Cottage City and Vineyard Sound, about 5 feet deep and 100 feet wide on the bottom, and has protected the same by building two stone jetties on either side of the cut, extending into the sound about 200 feet beyond the low-water mark, reaching a depth of about 8 feet at mean low water. . . . The United States Lighthouse Board is willing to maintain lights on the end of the jetties. The ends of the jetties are built up (as are the entire jetties) by loose stones piled up, between the interstices of which the water readily flows.”

The question submitted by your letter is, whether the Board may convey the land upon which the ends of the jetties have been erected to the United States for the purpose of maintaining lights and lighthouses thereon, it being one of the provisions of the U. S. Revised Statutes that no lighthouse shall be erected on any site until “ cession of jurisdiction over the same has been made to the United States.”

The authority of your Board is to be found in Public Statutes, chapter 1, section 7, which provides : “ The board of harbor and land commissioners, with the approval of the governor and council, may in the name and behalf of the Commonwealth convey to the United States the title of the Commonwealth to any tracts of land covered by navigable waters, and necessary for the purpose of erecting lighthouses, beacon lights, range lights, or other aids to navigation, or lightkeepers’ dwellings, upon the application of any authorized agent or agents of the United States : *provided*, that such title shall revert to and revest in the Commonwealth whenever such land ceases to be used for such purposes.” There can be no doubt that the circumstances of the case bring it within the provisions of this statute.

The jetties extend out 200 feet below low-water mark, and reach to a depth of 8 feet at mean low water. They are built of loose stones, through the interstices of which the water readily flows. The soil upon which the jetties rest is, therefore, the property of the Commonwealth, and title to it may be conveyed by your Board to the United States, under the statute quoted and subject to the conditions named therein.

Very truly yours,

H. M. KNOWLTON,
Attorney-General.

MENAMSHA INLET.

In July an examination was made of the structures which have been built since 1897 at the mouth of Menamsha Inlet in Chilmark. The works generally were found in good condition, the entrance channel being larger than at any time since the construction of the jetties. The timber structure which had been built to the westward of the westerly jetty had caused the beach to build up, and prevented the sand from being driven into the channel so far as it extended; but beyond it, as the beach was built up, sand was driven through spaces between the stones of the jetty. These holes can be closed at slight expense.

On the easterly side the current has cut away the sand from behind the wing of the jetty which extended along the beach, and the river channel thus widened has shoaled to some extent.

Before doing anything, it was decided to make a survey, to determine the exact status of the situation, and this was done in September. The cutting in rear of the easterly wing jetty was increasing, therefore it was deemed advisable to make plans and estimates for straightening the channel of the creek, as was originally contemplated. The estimates, however, of the cost of doing all that would be necessary if once started, were so large as to preclude action by the Board without special authority. Since then in a heavy north-easterly storm a section of the wing jetty has been overthrown, and a large quantity of sand and gravel deposited in the channel. No danger that the water of the creek will break through and make another opening, however, need be apprehended.

The jetties at the entrance of this harbor were originally

located at equal distances on either side of the boundary line between the towns of Chilmark and Gay Head, in substantially the middle of the outlet of the creek across the bar, at a point about 450 feet westerly from the bend where the main channel of the creek approached and ran along inside the beach; thus the creek, in flowing toward the beach along inside it and thence out through the jetties into the sound, turned at practically two right angles in its course.

In case it shall be thought best to carry out the project as originally planned, and secure the best results from the construction of the jetties, it will be necessary to excavate a channel across the flats from the entrance between the jetties toward the inner end of the bluff near the Tilton house, and to build two short jetties or training walls at either end of the excavated channel, to direct the current into it. To do this would tend to permanently deepen the entrance and enlarge the present harbor. The cost would probably not exceed the sum of \$5,000.

The total amount expended is \$9,952.20.

WITCHMERE HARBOR.

During a heavy south-west gale in the spring of 1901 a few of the stones in the western jetty, built by the Commonwealth in 1899 and 1900, were washed off and dropped into the channel. At the same time considerable quantities of sand were washed from the beach over the top of the jetty into the channel. In September these stones were replaced in the jetty, and a timber bulkhead built on the crest of the beach to prevent the sand from driving over the top of the jetty. The total expense of this work was as follows:—

Repairs and materials,	\$99 04
Surveys and supervision,	26 80
	<hr/>
Total,	\$125 84

While this work was in progress a survey was made of the channel, which was found to have been scoured by the current, as was expected, and to a greater depth throughout its length than in the previous year.

The people living in the vicinity are much disturbed by the quantities of seaweed driven onto the beach and held there by the jetties. This is a serious interference with the use of the beach for bathing and its enjoyment by the summer visitors; but if the jetties were removed and the seaweed allowed to drift along the beach, large quantities would drive into the harbor and land just at the inner end of the entrance channel, as it did before the construction of the jetties. The decay of the seaweed lodging on the beach gives forth offensive odors. There seems, however, to be no remedy for the nuisance created by this collection of seaweed except by removing it.

This is a duty which the Board, when applied to by the selectmen, decided was beyond its scope, but suggested that possibly the stuff had a commercial value if removed from the water and dried, in which case the cost of doing the work might be repaid by the sale of the material, thus keeping the beach clean, and giving employment to a number of the inhabitants.

The total amount expended is \$4,824.17.

SCORTON HARBOR.

An inspection and examination of the mouth of Scorton harbor was made in November last. The mouth, as was not unexpected, has been shoaled and diverted along the coast to the south-east, owing to the movement of material along that unprotected shore. It affords an instance of the necessity of protecting by jetties the mouth of rivers which debouch through a sandbar or spit. The action of the waves in stormy weather, stirring up the sand, and of the currents in moving the particles along and finally depositing them where there is less motion of the water, renders it futile to dredge an entrance in an exposed situation without thoroughly protecting it, as has been done by this Board at other outlets. The appropriation in this instance made no provision for jetty work.

The total amount expended is \$2,948.47.

PLYMOUTH HARBOR.

In March the Boston, Plymouth & Provincetown Steamboat Company made request that a shoal in the channel of Plymouth harbor near the wharf on Long beach be removed. On March 25 to 28 a survey was made, and it was found that the point of a flat in this portion of the channel projected so far as to make passage difficult, and plans were made for dredging a sufficient quantity of material to enable vessels to round it in safety.

On April 20 a contract was made with the Harries & Letteney Company, the lowest bidder, to do the work, for 28 1-2 cents per cubic yard, and it was completed May 10, 1901.

The total cost of this work is as follows:—

Dredging,	\$797 72
Surveys and supervision,	76 56
Total,	<hr/> \$874 28

The United States government in November of this year completed a dike of heavy riprap on Long beach, 10,468 feet in length, about 18 feet in height above mean low water, and containing 28,600 tons of stone. This work is of very substantial character, completely protecting the harbor, and was rendered necessary by the total destruction of all the government works along that part of the beach in the great storm of Nov. 27, 1898.

A test of the character of this new work was afforded in the severe storm of November 25 of the present year, when the gale, tide and surf approached at their maximum the conditions of 1898; yet the riprap withstood the heavy pounding of the sea without receiving damage at any point.

PROVINCETOWN HARBOR.

Although the importance of this harbor is such as to bring it within the care and supervision of the federal authorities, nevertheless, the Board exercises a watchful interest over its condition.

In April authority was granted the Boston, Plymouth & Provincetown Steamboat Company to dredge in Province-

town harbor for the improvement of the channel leading up to its wharf.

Early notice was received by the Board from its agent at Provincetown that the governmental protective works designed to prevent the influx of the ocean to the upper reaches of the harbor had been seriously impaired by the storm of November 25 last. The information was immediately transmitted to the federal authorities having charge of the works ; as should, by any chance, the ocean make a breach through the thin neck of sand at the upper end of the harbor, the consequences, though unforeseeable, could not but be injurious, if not destructive, to the harbor.

NEW BEDFORD HARBOR LINES.

In pursuance of an order of the Legislature of Feb. 4, 1901, requiring the Board to investigate the advisability of changing the harbor lines on the westerly side of Fish Island in the harbor of New Bedford, a hearing was duly advertised and held at the city hall in New Bedford on February 19.

After a full hearing, at which an opportunity was given to every one desiring to be heard, the Board reported a bill changing the harbor line, which was subsequently enacted as chapter 243 of the Acts of 1901.

The change in the line will unquestionably be beneficial to shipping obliged to pass through the new draw between Fish Island and Pope's Island for the purpose of discharging at the wharves opposite Fish Island just above the old bridge.

GREAT PONDS.

The growing public taste for summer outing places has led to the occupation of the shores of great ponds and the islands to a degree never before experienced.

The title to and ownership of islands in great ponds often present questions of novelty and importance.

Application is not infrequently made to the Board for leases of such islands ; and now and then the attention of the Board is directed to the occupancy of an island to which it is claimed the occupant has no title, but is squatting on the lands of the Commonwealth.

With reference to leasing the islands, the Board is inclined

to view them as affording increased opportunity for public enjoyment of the rights secured by the Colony Ordinance of 1647 in the great ponds themselves, and not, therefore, as possessions to be appropriated to the exclusive and particular use and enjoyment of private individuals, and has consequently declined hitherto to grant leasehold interests to those petitioning for them.

Before taking action with reference to such islands as may appear to belong to the Commonwealth, but as to which the title is doubtful, the Board took the opinion of the Attorney-General, whose letter, addressed to the chairman, reads as follows :—

DEAR SIR :— Your letter of October 8 states that the Board of Harbor and Land Commissioners desires to be informed “whether or not islands in great ponds to which no private individual has title are property of the Commonwealth, with reference to the possession of which this Board has a duty to perform.”

The term “great pond” has been used in the statutes of the Commonwealth from time immemorial. It originally signified an inland body of water, consisting of ten acres (Colony Ordinance of 1647) ; but this area was subsequently increased, in the case of the public right of fishing, to twenty acres. (Statutes of 1869, chapter 384, section 7.)

The original grants from the King, in the case of the Colony of Plymouth and the Colony of Massachusetts Bay as well, gave to the colony the title to all lands within the Commonwealth, including great ponds. This provision was also incorporated into the charter of the Province of Massachusetts Bay ; and the title to such lands and ponds, unless previously parted with, was, both before and after the Revolution, in the State. “These charters [the several charters to the colonies and the Province] vested in the grantees not only the right of soil, but also large powers of government and the prerogatives of the crown in the sea shores, bays, inlets, rivers and other property which were held for the use and benefit of all the subjects.” (*Watuppa Reservoir Co. v. Fall River*, 147 Mass. 548, 554. See also *Commonwealth v. Roxbury*, 9 Gray 451, 483 ; *Commonwealth v. Alger*, 7 Cush. 53.)

From a very early period the law of Massachusetts has treated great ponds as of a character closely resembling tide waters, the enjoyment of which for fishing, fowling and other purposes was common to all, and the title in and lands under which could not be made the subject of private ownership without special grant from

the Legislature. (*Paine v. Woods*, 108 Mass. 160; *Ancient Charters*, 148, 149. See also *Commonwealth v. Vincent*, 108 Mass. 441; *West Roxbury v. Stoddard*, 7 Allen, 158.) Thus it was provided in the Colony Ordinance of 1641 that every inhabitant should have free fishing and fowling in any great ponds . . . within the precincts of the town where they dwelt, unless the freemen of the town or the General Court had provided otherwise. (*Body of Liberties*, 1641.) Later, it was provided that no town should appropriate to any person or persons any great pond containing more than ten acres. (Ordinance of 1647.)

These ordinances applied to all great ponds exceeding ten acres in area which in 1647 had not been appropriated to particular persons, either by the freemen of the town or by the General Court. (*West Roxbury v. Stoddard*, *supra*.) The Commonwealth therefore owns the great ponds as public property held in trust for public purposes. It has the ownership of the soil, including, obviously, the soil of islands within the area of such ponds, and also the right to control and regulate the public uses to which the ponds shall be applied. (*Watuppa Reservoir Co. v. Fall River*, 147 Mass. 557.) In such ponds a grant bounded by the pond extends only to low-water mark. (*Waterman v. Johnson*, 13 Pick. 261, 265; *Paine v. Woods*, 108 Mass. 160.) The proprietors of land bordering upon the ponds have no rights in the soil or in the waters, unless it be by grant from the Legislature. (*Watuppa Reservoir Co. v. Fall River*, 147 Mass. 557.)

It follows that the title to lands in great ponds is, in the absence of any grant from the Legislature or from the freemen of a town, prior to 1647, in the Commonwealth. Being lands the title to which is in the Commonwealth, the duties of your Board relating to the same are prescribed by Revised Laws, chapter 96, section 3.

Very truly yours,

HOSEA M. KNOWLTON,
Attorney-General.

TOWN BOUNDARY SURVEY.

In June, the Board, under authority of chapter 469 of the Acts of 1901, assumed the duties pertaining to the Commission on the Topographical Survey and Map of Massachusetts, and has continued the work begun by that commission.

During the first part of the year, up to the time the Topographical Survey Commission was consolidated with this Board, the work was confined to working up the results from the field work of the previous year, and in preparing and superintending the printing of the boundary atlases.

Since then surveys have been made by one party to complete the location of the boundaries in eleven towns in Norfolk County, including the surveys of streams and roads forming boundaries between these and adjoining towns. Another party was employed on similar work in Barnstable, Essex and Middlesex counties a portion of the time, and the balance of the time on the surveys for the Taunton River and Boston harbor canal. The office force has been employed in the preparation of the town boundary atlases, and in calculating the location of the town corners from data furnished by the work of the field parties. The calculations of the position of the town corners determined between the years 1893 and 1900, which were delayed, awaiting the completion of the primary triangulation work on which it was based, have been completed and the location of the corners filed in the card catalogue. The compilation of the statutes defining the boundaries of thirty-four towns has been completed.

Since January 1, atlases of one city and three towns have been published, viz., Springfield, Raynham, Norton and Rehoboth; and atlases of two towns, Arlington and Sandwich, which were partly printed in June, are now in press.

The plan of publication has been changed so as to materially reduce the expense. Instead of publishing an atlas of each town, adjacent towns are grouped together and published in one atlas, and the printing of the pictures of the bounds at the town corners is omitted.

One atlas including the towns of Cohasset, Hingham, Hull and Weymouth, has been prepared, and is now in press.

The town boundary work done during the year has been less than the year before, owing to the diversion of a portion of the employees to the surveys for the Taunton River and Boston harbor canal; but by transferring the employees from one class of work to another, all necessary results of interest to the Commonwealth have been accomplished.

SALE OF MAPS.

During the year, under chapter 57 of the Resolves of 1890, 14 atlases, one folio and 2,527 additional sheets of the State topographical maps have been sold, for \$187.40.

Under chapter 360 of the Acts of 1900, 4 town boundary atlases have been sold for \$15, and 3 Rhode Island and Massachusetts boundary line plans for \$0.96. Two hundred and sixteen atlases were sent to the officers of the various cities and towns, as provided by law. Under chapter 95 of the Resolves of 1891, 10 atlases and 2 extra portfolios have been distributed, 5 of these being sent to free public libraries. The proceeds of the above sales have been paid to the State Treasurer. It was voted to send a set of town boundary atlases to the U. S. Coast and Geodetic Survey office.

The bounds to mark the portions of the boundary lines between the city of Marlborough and the town of Southborough, between the towns of Carver and Wareham, and between the towns of Lynnfield and Saugus, as established by chapters 393, 394 and 407 of the Acts of 1901, have been set by the local authorities, and plans for filing with the Secretary of the Commonwealth, provided for in the various acts, are being prepared.

STATE BOUNDARIES.

During the year the monuments marking the boundary line between Massachusetts and New Hampshire which were found to be missing or to have been displaced when the line was perambulated last year, have been set and replaced.

The monument on Salisbury beach, which was washed out by the storm of November, 1898, was reset in its original location at a lower grade. The Boston & Maine Railroad set certain monuments which were reported displaced, one at the Merrimac branch, and the other at the Nashua & Acton branch of its road; and also furnished and set a new monument at the intersection of the boundary line with its western division main line. These were subsequently examined, and found to be set in the proper location. The filling was replaced around the monument at the Townsend Hill road between Townsend, Mass., and Brookline, N. H., where it had been cut away by the water in flowing down the road. Where the boundary line crosses Lake Monomonac, between the towns of Winchendon, Mass., and Rindge, N. H., the line was not marked for a distance of 6,697 feet. The shores of the lake are being rapidly occupied by summer cottages.

At the suggestion of Hon. J. B. Tennant, of the Governor's Council of New Hampshire, to whom was delegated the duty of co-operating with the Board in this work, it was decided to place three additional monuments along that line : First, a granite monument, similar to those already set on this section of the line, at a point 1,476 feet east of the monument at the road on the westerly side of the lake. Second, a cast-iron post, at a point 3,108 feet further east. This iron post is of the same pattern as those set on the line between Massachusetts and New York. At a point 426 feet east of this post is a wrought-iron bolt, which is set in a small boulder on the line. Third, a stake has been set to mark the location for the third monument, at a point 938 feet east of the cast-iron monument and 1,179 feet west of the monument at the road on the easterly side of the lake. As this point is difficult of access except across the lake, the setting of the monument has been postponed until this winter, when it can be transported on a sled across the ice. The monument is of granite, and similar to the others on this portion of the line, and will be set as soon as the weather permits.

Owing to the pressure of other duties, nothing has been done toward replacing the monuments on the line between Massachusetts and Rhode Island, which were found to be displaced or missing when the line was perambulated last year, but it is proposed to do this work the coming season. Upon its completion the line between Massachusetts and Connecticut will be the only portion of the boundary of the State not fully marked in a permanent manner; and some arrangement should be made to re-run and mark this line, whenever the State of Connecticut shall be ready to take up the matter.

In the report of the Commission on the Topographical Survey and Map of Massachusetts for 1898, the cost of relocating and marking the Connecticut line was estimated to be \$14,000, of which one-half should be paid by each State. This estimate was based on the cost of the work which had been done by them in relocating and marking the line between Massachusetts and New York.

82 HARBOR AND LAND COMMISSIONERS. [Jan.

Amount paid into treasury by the Commission on the Topographical Survey and Map of Massachusetts from sale of maps, etc., from Jan. 1, 1901, to June 7, 1901, inclusive, . . .	\$104 95
Amount paid into treasury by Harbor and Land Commission from sale of maps, etc, from June 8, 1901, to Nov. 30, 1901, inclusive,	98 41
Total,	\$203 36

PROVINCE LANDS.

Three years ago the Legislature appropriated \$10,000 to be spent during the succeeding three years in the improvement of the Province Lands.

It is now eight years since the care of the Province Lands was committed to the Board for reclamation. In that time the Legislature has appropriated \$23,000. With the expenditure of that money about 170 acres of the blowing sands have been reclaimed and protected from movement by the violence of the winds. Also from that fund a much-needed road, about 10,200 feet long, has been built across the sand barrens to the Race Point life-saving station, at a cost of about \$3,450, or a little less than 34 cents a running foot.

The reports of the superintendent under whose supervision this work has been performed have been published in the annual reports of the Board from year to year. Their perusal will show the steady although necessarily slow improvement which has been effected during the period of his care.

The progress of the work has been viewed by scientific men from the agrostological department at Washington and elsewhere with great interest. The results have fully answered expectations, and the method of reclamation adopted has met with unqualified approval.

In order to complete the work, it will be desirable to reclaim about 115 acres more of the sand barrens, after which there need be no apprehension of danger from the blowing of the sands on the lands of the Commonwealth. The shrubs and young trees are growing up among the beach grass, and are doing extremely well.

The sum of \$68.36 has been collected during the season, and turned over to the Treasurer of the Commonwealth.

The appropriation is exhausted to an unexpended balance in the treasury of 21 cents, and, unless renewed at the coming session of the Legislature, further improvement and care of the lands will have to be discontinued.

The report * of the Superintendent of the Province Lands may be found in the Appendix.

WRECKS.

Under chapter 260 of the Acts of 1883, the Board is authorized to remove wrecks and other obstructions from tide waters. The work done during the year is as follows:—

A portion of a small vessel lying on the water pipes of the Metropolitan Water Board was removed from Chelsea Creek in March and April, under an agreement with Alfred S. Sorensen, at a cost of \$50.

Forty-seven ancient piles, forming part of the old bridge which formerly connected the westerly end of Breed's Island with Chelsea, and was removed many years ago, were complained of as causing an obstruction to navigation in Chelsea Creek, and were taken up in April, under an agreement with W. H. Wyman, at a cost of \$228.

A large boulder in Charles River, opposite Hoosac Tunnel docks, liable to cause wrecks, was removed in May, under an agreement with Geo. W. Townsend, at a cost of \$75.

On July 23 a request was received from the city engineer of Gloucester for an inspection of Gloucester harbor, with a view to removing certain ledges and boulders which were obstructing navigation. After a conference with the city engineer, August 15, it appeared that the boulders complained of were situated at the entrance to a private slip, where they obstructed the passage of vessels only to and from that particular wharf; the Board therefore did not consider it to be a case that called for action by the State. The ledges complained of were found to be so large and extensive that the Board did not feel justified in undertaking their removal without further legislation.

In September complaint was received that in rebuilding the bridge in the highway between Wareham and Marion,

* See Appendix C.

over the Weweantitt River, the contractor had broken or cut off the piles of the old bridge at or about the level of low water, and that a considerable number of them were a serious obstruction, and dangerous to small boats passing under the new bridge. After investigation, the matter was brought to the attention of the State Highway Commission, under whose direction the work was being done, and the obstructions were removed.

Also a large boulder projecting above the bottom of Boston harbor, at a point about 50 feet from the southerly corner of Central wharf, was removed in October, under an agreement with Geo. W. Townsend, at a cost of \$46.

The attention of the Board was called to the fact that the wharf of the Plymouth Stove Company at Plymouth was in a dilapidated condition, and rapidly being washed away by the sea into the channel. Upon notice to the company that injury threatened the channel, repairs were finally made.

SURVEYS.

The work done by the Engineering Department during the last year has been larger than that of any previous year, and the number of employees has been proportionately increased during the summer season.

In addition to the work on the Commonwealth flats at South Boston, special surveys were made of the mouth of Bass River in Dennis and Yarmouth, Herring River in Harwich, and Apponagansett harbor in Dartmouth, under the Resolves of 1901, with a view to determining what improvements could be made at these places; also a survey, under chapter 104 of the Resolves of 1901, for the purpose of estimating the probable cost of constructing a canal from Taunton River to Boston harbor, which included the examination and mapping of the route, 40 miles long.

Other surveys have been made in connection with the general work of the Board, as follows:—

In December, 1900, the surveys of Bird Island shoal, as a basis for making plans for an anchorage basin, were completed.

December 13, a survey was made of the area which had been dredged as a berth for the nautical training ship

“Enterprise” at North End Park, to ascertain if the excavation had been properly completed.

December 19, a survey was made to ascertain the amount of filling which had been placed by the contractor in rear of the concrete sea wall built at the Sand Hills in Scituate.

In December, 1900, and January, 1901, surveys were made of a portion of Fort Point Channel, from Congress Street bridge to Rowe's wharf, preparatory to contracting for dredging to a depth sufficient to accommodate the increased size of vessels coming to the wharves in this locality. In May surveys of the same territory were made upon the completion of the dredging.

January 2 and 4, a survey was made to ascertain the extent of certain obstructions caused by piles in an old bridge which formerly crossed Chelsea Creek, opposite Breed's Island.

February 5, levels were taken to ascertain the elevation of the bench marks which had been placed on Congress Street bridge by the superintendent, showing the heights reached by the water during storms.

In February, March and April, the plane table survey of Mystic River was continued, some of the earlier sheets of the river were corrected and brought up to date in locations where extensive changes and improvements had been made, and two additional sheets completed.

March 25 to 28, a survey was made of the channel in Plymouth harbor, at the point just south of Long Beach, with a view to straightening the channel by cutting off a portion of the bend.

In April and June, surveys were made at Point Shirley and Shirley Gut, preparatory to excavating the shoaling which had taken place, also of the location of the dredging which had been done.

May 9 to 14, a survey was made of the channel of Winthrop harbor, to ascertain the location of shoals.

May 16 to 18, a survey was made of the channel which had been excavated into West Bay at Osterville, to determine what changes had taken place.

May 27 to 30, a survey was made at Lake Anthony, in Cottage City, as a basis for planning the work of excavating the anchorage, and of the approaches to the landing.

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May 29, a survey was made of property on Chelsea Creek, in Chelsea, formerly owned by White, Holman & Co., to ascertain the amount of tide water which had been displaced. June 10 to 12, a survey was made of the entrance channel at Green Harbor, to determine what changes had taken place.

June 25 to 27, a survey was made of Stony beach, in Hull, preparatory to making plans for a sea wall to protect the beach.

In August, September and October surveys were made relative to the work of improvement at Lake Anthony.

September 16, a survey was made of the embankment which the Old Colony Railroad Company had built across South Bay, to ascertain the amount of tide water which had been displaced thereby.

September 19 to 21, a survey was made of Menamsha Creek, in Chilmark, to determine what changes had taken place since the construction of jetties by the Commonwealth.

October 31, a survey was made of shoals in Boston harbor near Union wharf.

INSPECTIONS MADE BY THE BOARD DURING THE YEAR.

1900.

Dec. 7. Commonwealth flats at South Boston.

1901.

Feb. 4. Stony beach, in Hull, in company with legislative committee, relative to proposed protective works.

Mar. 22. Boston harbor and proposed anchorage ground at Bird Island shoal, in company with legislative committee.

Mar. 29. Commonwealth flats at South Boston.

April 5-6. Entrance to Bass River, in Dennis and Yarmouth, under authority of chapter 39 of the Resolves of 1901.

Jetties and channel at Osterville, relative to condition of work done under direction of the Board.

April 9. Protective works on the Connecticut River, in Hadley and Northampton.

April 17. Commonwealth flats at South Boston.

April 25. Work in progress at Union wharf.

April 29. Site of proposed structures in Buzzards Bay, at Monument beach.

1901.

- April 30. Work in progress on survey of entrance to Bass River, in Dennis and Yarmouth, authorized by chapter 39 of the Resolves of 1901.
- May 2-3. Banks of the Connecticut River, in Northampton and Hadley, with legislative committee, relative to protective work.
- May 4. Work done at outlet of Maquan Pond, in Hanson.
- May 8. Wharf property of the Boston Fire Brick and Clay Retort Manufacturing Company and the Boston Electric Light Company, at L Street, in South Boston.
- May 9. Commonwealth flats at South Boston, and proposed site of Northern Avenue and bridge, in company with legislative committee.
- May 17. Concrete sea wall on the beach at the Sand Hills, in Scituate, built under direction of the Board; also other localities in Scituate where it is desired to have the Board do certain work under chapter 434 of the Acts of 1900.
- New mouth of North River, in Scituate.
- May 24-25. Witchmere harbor, in Harwich, relative to condition of work done under direction of the Board.
- Herring River, in Harwich, relative to improvement authorized by chapter 66 of the Resolves of 1901.
- Entrance to Bass River.
- Jetties and channel at West Bay, in Osterville.
- May 28. Structure in tide water near the railroad station at West Manchester, on complaint made by property owners.
- June 7. Site of proposed work of New England Gas and Coke Company on Island End River, in Everett.
- June 29. Work done by the Commonwealth on the Province Lands in Provincetown.
- July 12-13. Apponagansett harbor, relative to survey authorized by chapter 38 of the Resolves of 1901, and Lake Anthony, in Cottage City, relative to further improvements.
- July 16. Location for canal near Brockton, under chapter 104 of the Resolves of 1901.
- July 18-19. Banks of the Connecticut River at Northampton and Hadley, relative to a continuation of the protective work in Hadley authorized by chapter 94 of the Resolves of 1901.

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1901.

- July 23. Stony beach in Hull, relative to location of sea wall authorized by chapter 483 of the Acts of 1901.
Location of proposed canal line between Weymouth and Holbrook.
- July 25. Work of filling the parkway on Charles River, near Brookline bridge, in Cambridge.
- July 31. Location of proposed canal line between Taunton and West Bridgewater.
- Aug. 5. Structures in Lake Chaubunagungamaug, in Webster.
- Aug. 6. Commonwealth flats at South Boston.
- Aug. 14-15. Work of setting buoys and dredging in Lake Anthony, at Cottage City.
Jetties and channel at Menamsha Inlet, relative to work done under direction of the Board.
- Aug. 19. Work of placing a monument on Salisbury beach, marking the boundary line between Massachusetts and New Hampshire.
- Aug. 25. Jetties and channel at West Bay, Osterville, relative to work done under the direction of the Board.
- Aug. 27. Structures projecting beyond the harbor line on Merrimac River, in Haverhill.
- Aug. 28. Bridges over Weweantitt River and Wankinco River, in Wareham.
- Aug. 29-30. Protective work in progress on the bank of the Connecticut River at Hadley, under direction of the Board, and work done at West Springfield.
- Sept. 4. Commonwealth flats at South Boston.
- Sept. 9. Work done under the direction of the Board at Witchmere harbor, in Harwich; entrance to Bass River, in Dennis and Yarmouth, relative to further surveys.
- Sept. 12. Lake Anthony, in Cottage City, relative to work in progress, under direction of the Board.
- Sept. 24. Work in progress on survey for proposed canal between Taunton and Somerset.
- Sept. 26. Cedar Pond and Dunham Pond, in Carver, relative to petitions for authority to take water from said ponds for flowing cranberry bogs.
- Sept. 28. Protective work in progress on the bank of the Connecticut River in Hadley, under direction of the Board.
- Oct. 3. Ragged Island in Hingham harbor.
- Oct. 11. Commonwealth flats at South Boston.

1901.

- Oct. 18. Work done by the Commonwealth on the Province Lands in Provincetown.
- Oct. 19. East Bay in Osterville.
- Oct. 22. Property of Fore River Ship and Engine Company, on Weymouth Fore River, in Quincy.
- Oct. 23. Commonwealth flats at South Boston.
- Oct. 24. Structures and sites of proposed sewer outlets in Plymouth harbor.
- Oct. 26. Protective work in progress on the bank of the Connecticut River in Hadley, under direction of the Board.
- Nov. 9. Mouth of Scorton harbor, in Sandwich, relative to condition of work done under authority of chapter 442 of the Acts of 1898.

LICENSES GRANTED DURING THE YEAR.

- Nos.
2434. Petition of Jens Bertelsen and John P. Petersen for license to fill solid in Boston harbor at East Boston. Granted Dec. 3, 1900.
2435. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to reconstruct a portion of the westerly side of its Pier No. 1 in Boston harbor at East Boston. Granted Dec. 4, 1900.
2436. Petition of the Suburban Gas and Electric Company for license to build and maintain a pile wharf, construct a crib, lay pipes and dredge a basin in Chelsea Creek in the town of Revere. Granted Dec. 27, 1900.
2437. Petition of the Lynn & Boston Railroad Company for license to dump snow and ice into Mystic River from Chelsea bridge over the north channel of said river. Granted Jan. 7, 1901.
2438. Petition of Matthew J. Connors and James E. Cavanagh for license to build and maintain a pile wharf and dredge a channel in Weymouth Fore River at Hough's Neck in the city of Quincy. Granted Jan. 7, 1901.
2439. Petition of Michael J. Kane for license to build and maintain an ice run in Dorothy Pond in the town of Millbury. Granted Jan. 7, 1901.
2440. Petition of Hannah G. Shaw for license to build and maintain retaining walls and fill solid in East River in the town of Wareham. Granted Jan. 7, 1901.

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Nos.

2441. Petition of Nathan F. Tufts and others for license to build a bulkhead and fill solid in Mystic River, adjoining Charlestown Park, in the city of Boston. Granted Jan. 7, 1901.
2442. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to widen and extend its Pier No. 7 in Boston harbor at East Boston. Granted Jan. 7, 1901.
2443. Petition of Henry W. Smith for license to build a bulkhead and fill solid in Chelsea Creek, adjoining Marginal Street, in the city of Chelsea. Granted Jan. 7, 1901.
2444. Petition of Cashman Brothers for license to build a bulkhead and pile fenders, to extend wharf and fill solid in Merrimac River in the city of Newburyport. Granted Jan. 7, 1901.
2445. Petition of Albin Leal Richards for license to fill solid in Mystic River at his wharf adjoining Medford Street in the city of Boston. Granted Jan. 9, 1901.
2446. Petition of Henry H. Fay for license to build and maintain a wharf, partly solid and partly on piles, in Wood's Hole Great Harbor, at Wood's Hole in the town of Falmouth. Granted Jan. 11, 1901.
2447. Petition of Willard Howland for license to fill solid and build a pile platform in Chelsea Creek at East Boston. Granted Jan. 25, 1901.
2448. Petition of the Trustees of Fiske Wharf and Warehouse Trust for license to build a bulkhead and pile structure and fill solid in a dock adjoining Fiske wharf in the city of Boston. Granted Feb. 4, 1901.
2449. Petition of the Board of Metropolitan Sewerage Commissioners for approval of plans for constructing a sea wall and pile platform, and for filling solid in Chelsea Creek at East Boston, as authorized by chapter 439 of the Acts of 1899. Granted Feb. 28, 1901.
2450. Petition of the Boston Electric Light Company for approval of plans for laying a cable across Fort Point Channel at Dover Street bridge in the city of Boston, under authority of chapter 249 of the Acts of 1898. Granted Feb. 28, 1901.
2451. Petition of the Board of Metropolitan Park Commissioners for license to excavate, fill solid and change the southwesterly shore line of Charles River, in the city of Boston, from near Boylston Street bridge to a point opposite the Cambridge Hospital grounds. Granted Feb. 28, 1901.

Nos.

2452. Petition of the city of Boston for license to build a pile wharf for the support of a coal shed in Boston harbor at the South Ferry in East Boston. Granted Feb. 28, 1901.
2453. Petition of the Metropolitan Steamship Company for license to widen and extend Union wharf on piles in Boston harbor in the city of Boston. Granted Feb. 28, 1901.
2454. Petition of Job L. Cole for license to build and maintain an ice run in Fresh Pond in the town of Plymouth. Granted Feb. 28, 1901.
2455. Petition of the Boston Fire Brick and Clay Retort Manufacturing Company for license to extend two pile wharves and fill solid in Boston harbor, near the Reserved Channel at South Boston. Granted March 7, 1901.
2456. Petition of Edward W. Chadwick for license to extend his pile pier in Edgartown harbor at Chappaquiddick in the town of Edgartown. Granted March 7, 1901.
2457. Petition of the Massachusetts Pipe Line Gas Company for approval of plans for building pile structures and laying a gas main in, over and under Island End River in the cities of Everett and Chelsea, under authority of chapter 537 of the Acts of 1896. Granted March 7, 1901.
2459. Petition of the South Bay Company for license to fill solid in South Bay in the city of Boston. Granted March 15, 1901.
2460. Petition of the Hanley Construction Company for license to build and maintain a wharf, partly solid and partly on piles, on Town River in the city of Quincy. Granted March 18, 1901.
2461. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to rebuild its sea wall at the head of Dock No. 1, Grand Junction wharves, at East Boston. Granted March 18, 1901.
2462. Petition of the city of Boston for license to widen Alford Street by filling solid, and to riprap the slope of said filling in Mystic River in the city of Boston. Granted March 18, 1901.
2463. Petition of Thomas E. Reed for license to widen and extend his wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted March 18, 1901.
2464. Petition of Catherine A. Meston for license to build and maintain a pier in Mattapoissett harbor in the town of Mattapoissett. Granted March 18, 1901.

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Nos.

- 2465. Petition of the New Bedford & Onset Street Railway Company for license to fill solid in Wareham River in the town of Wareham. Granted March 20, 1901.
- 2466. Petition of Julia W. Lowry for license to build and maintain a pile pier and float stage in Buzzards Bay at Josiah's Point in the town of Wareham. Granted March 25, 1901.
- 2467. Petition of Frederic S. Goodwin for license to extend his wharf, on piles, in Boston harbor at East Boston. Granted March 29, 1901.
- 2468. Petition of the Providence & Fall River Street Railway Company for license to build a pile bridge across Palmer's River and to fill solid in adjacent creeks in the town of Swansea. Granted April 3, 1901.
- 2469. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to enlarge its Pier No. 1 and Dock No. 2 and build a sea wall and pile platform in Boston harbor at East Boston. Granted April 4, 1901.
- 2470. Petition of the Trustees of the Hingham and Quincy Bridges for license to widen a portion of the present bridge on Weymouth Back River in the town of Hingham. Granted April 4, 1901.
- 2471. Petition of the town of Ipswich for license to build a sea wall and fill solid in Ipswich River in the town of Ipswich. Granted April 5, 1901.
- 2472. Petition of the city of Boston for license to rebuild the piers and wharves, on piles, at the East Boston landing of the South Ferry in Boston harbor. Granted April 15, 1901.
- 2473. Petition of the Metropolitan Water and Sewerage Board for approval of plans for laying pipes in Boston harbor from Nut Island, building a pile wharf and constructing embankments, in the city of Quincy and town of Hull, as directed by chapter 424 of the Acts of 1899. Granted April 17, 1901.
- 2474. Petition of William H. Norton for license to build and maintain a pile pier in Edgartown harbor in the town of Edgartown. Granted April 17, 1901.
- 2475. Petition of the Massachusetts Highway Commission, acting under authority of chapter 497 of the Acts of 1894 and acts amendatory thereto, for license to rebuild two bridges over the Weweantitt River in the towns of Marion and Wareham. Granted April 30, 1901.

Nos.

2476. Petition of Frank Stanwood for license to extend his wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted April 30, 1901.
2477. Petition of the Board of Park Commissioners of Arlington for license to build a dam, sluiceway and screen at the mouth of Mill Brook at Mystic Lake in the town of Arlington. Granted April 30, 1901.
2478. Petition of the town of Marblehead for license to build a sea wall and fill solid in Nick's Cove in the town of Marblehead. Granted May 3, 1901.
2479. Petition of the town of Bourne for license to build a sea wall and fill solid in Cohasset Narrows in the town of Bourne. Granted May 3, 1901.
2480. Petition of William F. Macy and John P. Fitts for license to build and maintain a pile wharf in Quincy Bay at Hough's Neck in the city of Quincy, and to dredge a basin and channel leading to said wharf. Granted May 3, 1901.
2481. Petition of Alfred S. Sorensen for license to build a wharf, partly solid and partly on piles, in Chelsea Creek, adjoining Marginal Street in the city of Chelsea. Granted May 10, 1901.
2482. Petition of George H. Richards and Howard Stockton, trustees of the Toby Club, for license to build and maintain a pile wharf, ways, dolphins and landing float, and to dredge in Buzzards Bay at Monument beach in the town of Bourne. Granted May 10, 1901.
2483. Petition of the Corinthian Yacht Club for license to build and maintain a wharf and landing stage in Marblehead harbor at Marblehead Neck in the town of Marblehead. Granted May 10, 1901.
2484. Petition of William H. Moore and Edwin C. Swift for license to build and maintain a pile pier and float, also to lay and maintain an iron pipe for drainage purposes in Salem harbor in the city of Beverly. Granted May 10, 1901.
2485. Petition of Albin Leal Richards for license to fill solid and extend his wharf, on piles, in Mystic River in the city of Boston. Granted May 10, 1901.
2486. Petition of the city of Cambridge, by its Board of Park Commissioners, for license to fill solid in Charles River, between points 240 feet east and 670 feet west of Putnam Avenue. Granted May 10, 1901.

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Nos.

2487. Petition of Benjamin F. Brown, trustee, the heirs of Nancy Lennon, Henry O. Marcy, Jennie G. Carter, Noah S. King, James A. Norcross and Orlando W. Norcross, for license to fill solid in Charles River between land of the Boston & Albany Railroad Company and land of Charles H. Souther and others in the city of Cambridge. Granted May 10, 1901.
2488. Petition of the city of Boston for license to repair and reconstruct the draw landing and fender on the South Boston side of Mt. Washington Avenue bridge on Fort Point Channel. Granted May 10, 1901.
2489. Petition of Eugene T. Adams and James F. Ring, co-partners under the firm name of Simonds & Adams, for license to build a sea wall and fill solid in Merrimac River in the city of Haverhill. Granted May 13, 1901.
2490. Petition of Reed & Gamage for license to build and maintain a pile wharf in Gloucester harbor in the city of Gloucester. Granted May 14, 1901.
2491. Petition of George F. Welch for license to widen and extend his wharf in Scituate harbor in the town of Scituate. Granted May 14, 1901.
2492. Petition of Samuel W. K. Brooks for license to rebuild, widen and extend his wharf, on piles, and to build launch ways in Boston harbor at Harbor View, East Boston. Granted May 16, 1901.
2493. Petition of the city of Boston for license to drive additional piles in the middle pier of the North Ferry, Boston landing. Granted May 27, 1901.
2494. Petition of the Gloucester Fish Drying Company for license to build and maintain a pile pier on Annisquam River in the city of Gloucester. Granted May 27, 1901.
2495. Petition of Robert W. Emmons, 2d, for license to build and maintain two pile piers and floats in Buzzards Bay at Mashnee Island. Granted June 3, 1901.
2496. Petition of the town of Wareham for license to rebuild and widen the highway bridge across the Wankinco River at Wareham Narrows. Granted June 3, 1901.
2497. Petition of the New Bedford & Onset Street Railway Company for approval of plans for building a pile bridge over the Wareham River at the Narrows, below the present highway bridge and westerly of and adjacent to the location of the New York, New Haven & Hartford Railroad Company, as authorized by chapter 132 of the Acts of 1901. Granted June 5, 1901.

Nos.

2498. Petition of the Brockton & Plymouth Street Railway Company for license to build and maintain a runway, on piles, and a float in Little Sandy Bottom Pond in the town of Pembroke. Granted June 5, 1901.
2499. Petition of the town of Marblehead for license to build a wharf in Marblehead harbor at Red Stone Cove. Granted June 12, 1901.
2500. Petition of Jennie W. Bliss for license to build and maintain a pile pier and float in Marion harbor in the town of Marion. Granted June 12, 1901.
2501. Petition of the Soule Mill for license to build bulkheads and fill solid in Acushnet River in the city of New Bedford. Granted June 14, 1901.
2502. Petition of the Board of Public Works of the city of New Bedford for license to build and maintain a six-foot brick sewer, on piles, in Acushnet River, in extension of the sewer built in Sawyer Street, in the city of New Bedford. Granted June 14, 1901.
2503. Petition of Edwin A. Grozier for license to build and maintain a boat house on piles at the south-easterly end of Central wharf in Provincetown harbor in the town of Provincetown. Granted June 14, 1901.
2504. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for approval of plans for building a pile bridge over Swift's River at Point Independence in the town of Wareham, as authorized by chapter 344 of the Acts of 1901. Granted June 19, 1901.
2505. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for approval of plans for building a pile bridge over Buttermilk Bay in the towns of Wareham and Bourne, as authorized by chapter 344 of the Acts of 1901. Granted June 19, 1901.
2506. Petition of the Brockton & Plymouth Street Railway Company for license to place poles in Plymouth harbor in the town of Plymouth, for the purpose of an overhead transmission line. Granted June 20, 1901.
2507. Petition of the Edison Electric Illuminating Company of Boston for license to build a sea wall and fill solid in Fort Point Channel in the city of Boston. Granted June 24, 1901.
2508. Petition of Henry A. Leonard, trustee, for license to build a wharf in Buzzards Bay in the town of Dartmouth. Granted June 26, 1901.

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Nos.

2509. Petition of Grace F. Allen for license to build a pile pier in Little Sandy Bottom Pond in the town of Pembroke. Granted June 26, 1901.
2510. Petition of James F. Smith, trustee, for license to build and maintain a pile pier in Priest's Cove at Pope beach in the town of Fairhaven. Granted June 26, 1901.
2511. Petition of the East Boston Athletic Association Boat Club for license to drive piles for the support of a boat house in Chelsea Creek, adjoining Meridian Street bridge at East Boston, and to maintain runways, a float and a floating bath house. Granted June 26, 1901.
2512. Petition of Felix Rackemann for license to build and maintain a pile pier and floats in Katama Bay in the town of Edgartown. Granted July 3, 1901.
2513. Petition of the Misery Island Club for license to build and maintain a pile pier and float in Salem harbor at Misery Island. Granted July 3, 1901.
2514. Petition of Cornelia S. Chapin for license to build a pile pier in Edgartown harbor in the town of Edgartown. Granted July 3, 1901.
2515. Petition of the Edison Electric Illuminating Company of Boston for license to extend its wharf, on piles, on Fort Point Channel in the city of Boston. Granted July 3, 1901.
2516. Petition of the Metropolitan Steamship Company for license to build a sea wall and to remove a portion of Union wharf in Boston harbor in the city of Boston. Granted July 3, 1901.
2517. Petition of the estate of John Manners for license to build a timber wharf and fill solid in Merrimac River in the city of Haverhill. Granted July 8, 1901.
2518. Petition of the city of Haverhill for license to build a timber wharf and fill solid in Merrimac River in the city of Haverhill. Granted July 8, 1901.
2519. Petition of Stefano Gardella for license to build a timber wharf and fill solid in Merrimac River in the city of Haverhill. Granted July 8, 1901.
2520. Petition of the city of Boston for approval of plans for building a temporary foot-bridge and fender across Fort Point Channel at Broadway bridge, under authority of chapter 452 of the Acts of 1900. Granted July 8, 1901.

Nos.

- 2521.** Petition of the East Boston Gas Company for approval of plans for building a pile structure for the support of a gas main across Chelsea Creek in the city of Boston and town of Winthrop, under authority of chapter 228 of the Acts of 1901. Granted July 10, 1901.
- 2522.** Petition of the Board of Metropolitan Park Commissioners for license to fill solid in Charles River and change the northerly shore line in the town of Watertown, between points 2,500 and 3,900 feet westerly from North Beacon Street bridge. Granted July 16, 1901.
- 2523.** Petition of the United States Steel Company for license to build a bulkhead and fill solid in a creek flowing into Malden River in the city of Everett. Granted July 18, 1901.
- 2524.** Petition of Alice V. McAloon for license to build and maintain a pile pier and float stage in Buzzards Bay at Long Neck in the town of Wareham. Granted July 18, 1901.
- 2525.** Petition of the Philadelphia & Reading Coal and Iron Company for license to build a sea wall and fill solid in a dock on Acushnet River in the city of New Bedford. Granted July 29, 1901.
- 2526.** Petition of the New Bedford Gas and Edison Light Company for license to build a sea wall and fill solid in a dock on Acushnet River in the city of New Bedford. Granted July 29, 1901.
- 2527.** Petition of the Quincy Electric Light and Power Company for license to extend its wharf, on piles, and to dredge in Town River in the city of Quincy. Granted July 29, 1901.
- 2528.** Petition of Caroline E. Bates for license to build a pier in Buzzards Bay in the town of Dartmouth. Granted July 29, 1901.
- 2529.** Petition of the West End Street Railway Company for license to build bulkheads and fill solid in Chelsea Creek at East Boston. Granted July 31, 1901.
- 2530.** Petition of the West End Street Railway Company for license to build a sea wall or bulkhead and pile wharf and fill solid in Mystic River at Charlestown in the city of Boston. Granted July 31, 1901.
- 2531.** Petition of the Boston Elevated Railway Company for license to build a sea wall and concrete piers, fill solid, widen its wharf on piles, and dredge in Boston harbor at Lincoln wharf in the city of Boston. Granted July 31, 1901.

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Nos.

2532. Petition of Edward N. Pigot for license to build and maintain a pile pier and float in Buzzards Bay in the town of Wareham. Granted Sept. 10, 1901.
2533. Petition of Arthur M. Phillips for license to build and maintain a pile pier and float stage in Onset Bay in the town of Wareham. Granted Sept. 10, 1901.
2534. Petition of the Beacon Park Company for license to maintain a pile and timber wharf, also a pile wharf and floats, in Lake Chaubunagungamaug in the town of Webster. Granted Sept. 10, 1901.
2535. Petition of Robert G. Shaw for license to build and maintain a pile wharf in Vineyard Haven harbor at West Chop in the town of Tisbury. Granted Sept. 10, 1901.
2536. Petition of the Hanley Construction Company for license to build pile structures in Town River in the city of Quincy. Granted Sept. 10, 1901.
2537. Petition of the city of Gloucester for approval of plans for laying a water pipe across Squam River in the city of Gloucester, under authority of chapter 451 of the Acts of 1895. Granted Sept. 23, 1901.
2538. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to remove Pier No. 3, Grand Junction wharves, and to enlarge and reconstruct Pier No. 4 and adjoining dock, in Boston harbor at East Boston. Granted Sept. 23, 1901.
2539. Petition of the city of Boston for approval of plans for building a temporary foot-bridge across Fort Point Channel at Broadway bridge in the city of Boston, under authority of chapter 452 of the Acts of 1900. Granted Sept. 25, 1901.
2540. Petition of Robert Treat Paine, 2d, trustee, for license to build a boat landing in Massachusetts Bay in the town of Manchester. Granted Sept. 25, 1901.
2541. Petition of David B. Newcomb, Jr., for license to build a sea wall or dam across the entrance to a dock in Sandy Bay in the town of Rockport. Granted Oct. 2, 1901.
2542. Petition of Albert C. Burrage for license to build a pile wharf in Boston harbor at Bumkin Island in the town of Hull. Granted Oct. 2, 1901.
2543. Petition of the town of Dartmouth for approval of plans for reconstructing the bridge over the Apponagansett River at the village of South Dartmouth, under authority of chapter 384 of the Acts of 1901. Granted Oct. 2, 1901.

Nos.

2544. Petition of the Orient Heights Yacht Club for license to drive piles in Boston harbor at East Boston, for the support of a club house. Granted Oct. 3, 1901.
2545. Petition of the Boston, Revere Beach & Lynn Railroad Company for license to fill solid a portion of its pile bridge, to rebuild a portion of the same and construct a double-track trestle, in Crystal Cove in the town of Winthrop. Granted Oct. 7, 1901.
2546. Petition of the county commissioners of Norfolk County for approval of plans for constructing a bridge, with approaches, across Weymouth Fore River, substantially replacing the present bridge at Quincy Point, under authority of chapter 456 of the Acts of 1900. Granted Oct. 9, 1901.
2547. Petition of Robert Winsor for license to build and maintain a pile pier and float and a marine railway, also to fill solid, in Red Brook harbor at Rocky Island in the town of Bourne. Granted Oct. 10, 1901.
2548. Petition of the East Boston Dry Dock Company for license to widen and rebuild, on piles, a portion of its northerly pier in Boston harbor at East Boston. Granted Oct. 10, 1901.
2549. Petition of the Boston Elevated Railway Company for license to dump snow and ice into tide waters. Granted Oct. 29, 1901.
2550. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River from the yard of the Fitchburg Railroad Company at the foot of Haverhill Street in the city of Boston. Granted Oct. 29, 1901.
2551. Petition of Peter T. Fallon and others for license to build a sea wall and fill solid in Town River in the city of Quincy. Granted Oct. 29, 1901.
2552. Petition of Ensign K. Tewksbury and others for license to fill solid in the basin north of Washington Avenue in the town of Winthrop. Granted Oct. 30, 1901.
2553. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for license to extend the easterly abutment of the bridge across Swift's River at Point Independence in the town of Wareham. Granted Nov. 5, 1901.
2554. Petition of the New Bedford Yacht Club for license to build and maintain a pile pier and float stage in Appona-gansett harbor in the town of Dartmouth. Granted Nov. 5, 1901.

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Nos.

2555. Petition of the county commissioners of Essex County for approval of plans for constructing a new bridge and approaches across Merrimac River between the city of Newburyport and the town of Salisbury, under the provisions of chapter 483 of the Acts of 1896 and chapters 517 and 526 of the Acts of 1901. Granted Nov. 8, 1901.
2556. Petition of the city of Boston for license to dump snow and ice into tide waters. Granted Nov. 11, 1901.
2557. Petition of the Fore River Ship and Engine Company for license to build wharves, piers, marine railway, and to fill solid and dredge in Weymouth Fore River and Bent's Creek in the city of Quincy. Granted Nov. 14, 1901.
2558. Petition of the Boston & Maine Railroad for license to extend Pier No. 5, Hoosac Tunnel docks, on piles, on Charles River in the city of Boston. Granted Nov. 27, 1901.

PETITIONS DENIED.

On Dec. 19, 1900, in the matter of the petition of Albin Leal Richards for license to build two pile wharves and a bulkhead, and to fill solid on Mystic River in Charlestown, the Board declined to grant a license in the manner and form requested by the petitioner, but subsequently a license was granted in modified form, upon filing an amended plan.

On January 16, S. A. Thayer and Wm. M. Stetson, petitioners for license to fill solid in Great Pond in the town of Braintree, were granted leave to withdraw, as the town, represented by the selectmen, and the water board, opposed the granting of a license, on the ground that the Legislature has authorized the use of the waters of this pond for domestic purposes and that the granting of the desired license would be detrimental to public interests.

On February 11, Walter S. Gordon, petitioner for lease of an island in Morse's Pond in Wellesley, was given leave to withdraw, as the granting of an exclusive use of the same would be contrary to public policy.

On April 12, the Board refused to authorize the Bay State Dredging Company to dump material dredged from Nantasket Channel on flats lying between White Head and Strawberry Hill, in Hull, being of the opinion that the material should be dumped at sea.

On April 30, the Board declined to lease an island in the town of Billerica.

On May 13, the Board declined to permit the removal of material from Green Island in Boston harbor.

On June 4, the Board declined to permit the removal of material from a beach in Marblehead harbor.

On June 12, George L. Stacy, petitioner for license to build a wall and fill solid in Wonson's Cove, in Gloucester, was granted leave to withdraw, the title of the petitioner to the land in question being in dispute.

On July 1, the Board, acting with the Railroad Commissioners, as a joint Board, refused to grant the petition of the Boston, Cape Cod & New York Canal Company for authority to issue stock and bonds, as previously stated on page 56.

On August 1, the Board declined to approve an amendment of section 3, chapter 38 of the Revised Ordinances of the city of Boston, relating to the passage of vessels through the draw in Charlestown bridge, on Charles River, as previously stated on page 23.

On August 15, the Board declined to remove certain boulders from Gloucester harbor, located at the entrance to a private slip, as previously stated on page 83.

On October 9, the Board decided, after full hearing, to take no action at present on the petition of Z. A. Tillson & Son, asking that license No. 1360, granted by the Board to Peleg McFarlin, authorizing the building of structures and drawing of water from Cedar Pond in Carver, be revoked.

MISCELLANEOUS PERMITS GRANTED DURING THE YEAR.

POINT SHIRLEY CLUB, to dredge gravel from its flats at Point Shirley, in the town of Winthrop. Granted Dec. 3, 1900.

NEW ENGLAND DREDGING COMPANY, to dredge not exceeding 100,000 cubic yards of gravel in Boston harbor westerly of Lovell's Island. Granted Dec. 20, 1900.

J. N. SMITH & Co., to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted Jan. 1, 1901.

PETER MCCONARTY, to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted Jan. 1, 1901.

ESTATE OF PATRICK O'RIORDEN, to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted Jan. 1, 1901.

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EDITH ANDREW, and Edith Andrew as trustee, to remove gravel from the beach at the south-easterly end of Prince's Head, a part of Peddock's Island in Boston harbor. Granted Feb. 14, 1901.

TRUSTEES OF THE MAIN STREET LAND TRUST, to dredge material from their flats in Charles River, on the Cambridge side of the channel, near West Boston bridge. Granted Feb. 18, 1901.

SAMUEL JAMES, 2d, to remove stone from the beach at Sheep Island in Boston harbor. Granted Feb. 28, 1901.

CITY OF HAVERHILL, to lay and maintain a cable on the bottom of Merrimac River, across the drawways in Haverhill bridge. Granted March 8, 1901.

JOSEPH L. BOARDMAN, to remove gravel from Salter's beach at Gurnet Point, in the town of Plymouth. Granted March 25, 1901.

TOWN OF HADLEY, to repair and protect the banks of the Connecticut River in Hadley. Granted April 12, 1901.

COLE BROTHERS, to dump material dredged at the site of the New Bedford and Fairhaven bridge, at North Ledge in New Bedford harbor. Granted April 15, 1901.

BOSTON, PLYMOUTH & PROVINCETOWN STEAMBOAT COMPANY, to dredge in Provincetown and Plymouth harbors. Granted April 25, 1901.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, to maintain its poles on the easterly side of E Street, on the Commonwealth flats at South Boston. Granted May 6, 1901.

W. C. BRAMWELL, to remove gravel and material from the beach at Skull Head, in the town of Hull. Granted May 9, 1901.

ALBIN LEAL RICHARDS, to construct a temporary pile platform on Mystic River, in the city of Boston. Granted May 10, 1901.

BOSTON, PLYMOUTH & PROVINCETOWN STEAMBOAT COMPANY, to dump material dredged from Provincetown harbor at a point south of Long Point Light. Granted May 16, 1901.

MOSES WILLIAMS, to dredge in Cedar Pond Creek, in the town of Bourne. Granted May 16, 1901.

WILLIAM J. TILLEY, to remove gravel from the beach bordering on Quincy Bay at Hough's Neck, in the city of Quincy. Granted May 22, 1901.

SAMUEL T. HUMPHREY, to remove stones from the beach southerly of the causeway connecting Marblehead and Marblehead Neck. Granted May 29, 1901.

BAY STATE DREDGING COMPANY, to dump material dredged in Chelsea Creek on flats northerly of Orient Heights near Chain bridge. Granted June 14, 1901.

ATLANTIC CLUB, to remove sand and gravel from the beach in front of upland belonging to said club at Point Allerton, in the town of Hull. Granted June 19, 1901.

QUINCY YACHT CLUB, to dredge flats in Boston harbor at Hough's Neck, in the city of Quincy. Granted June 20, 1901.

CHARLES H. SAWYER AND WILLIAM F. MACY, to dredge flats and a channel in Town River Bay, in the city of Quincy. Granted July 3, 1901.

FANNY C. ADAMS, to dredge gravel from Half Moon Island in Quincy Bay, in the city of Quincy. Granted July 3, 1901.

JOHN G. HALL & Co., to use a portion of the flats in the Reserved Channel adjacent to the Commonwealth flats, for the storage of logs; to erect, for temporary use, two dolphins in tide water; to erect an engine and derrick on land between the Reserved Channel and E Street. Granted July 3, 1901.

JOHN S. BALLOU, to remove material from Ragged Island, in Boston harbor. Granted July 12, 1901.

MARY A. HARVEY, to dredge a channel through flats in Quincy Bay at Hough's Neck, in the city of Quincy. Granted July 18, 1901.

BAY STATE DREDGING COMPANY, to dredge material in Shirley Gut from the shoal extending out from Deer Island. Granted July 29, 1901.

EASTERN DREDGING COMPANY, to dredge material from Mystic River, between Malden bridge and the Eastern Railroad bridge, also between Middlesex Avenue bridge and Foster's ship yard. Granted Aug. 1, 1901.

EASTERN DREDGING COMPANY, to dredge gravel from Boston harbor near Lovell's Island. Granted Aug. 2, 1901.

BAY STATE DREDGING COMPANY, to dredge material from Boston harbor near the south-westerly point of Deer Island. Granted Aug. 13, 1901.

FRANK J. HANNON, to use a frontage of the sea wall on the northerly side of the Reserved Channel, on the Commonwealth flats at South Boston, for landing, storing and removing gravel. Granted Aug. 14, 1901.

THOMAS MEANY, to use a frontage of the sea wall on the northerly side of the proposed Northern Avenue, easterly of the Commonwealth pier at South Boston, for landing, storing and removing sand and gravel. Granted Aug. 20, 1901.

NANTASKET BEACH STEAMBOAT COMPANY, to remove sand from the berths and around Pemberton pier in Hull. Granted Oct. 14, 1901.

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COLE BROTHERS, to dump material excavated for the foundation of the bridge over Apponagansett River in Dartmouth, at Bent's Ledge in New Bedford harbor. Granted Oct. 31, 1901.

ISAAC BLAIR & Co., to dump snow from Dover Street bridge into tide water in the city of Boston. Granted Nov. 25, 1901.

WORK OF THE UNITED STATES IN RIVERS AND HARBORS
OF THE COMMONWEALTH.

The Board is indebted to Lieut.-Col. W. S. Stanton and Capt. Harry Taylor, Corps of Engineers, U. S. A., who are in charge of river and harbor improvements in eastern Massachusetts, and Maj. Geo. W. Goethals, Corps of Engineers, U. S. A., who is in charge of similar work in southern Massachusetts, for the following statements, which show the work accomplished in the rivers and harbors of this Commonwealth during the fiscal year ending June 30, 1901:—

STATEMENT OF LIEUT.-COL. W. S. STANTON, CORPS OF ENGINEERS,
U. S. A.

BOSTON, MASS., Dec. 13, 1901.

Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, Boston, Mass.

SIRS:—In accordance with your request of Dec. 2, 1901, I have the honor to furnish the following summary of work done by the United States during the fiscal year ending June 30, 1901, in the rivers and harbors of Massachusetts in my district.

The works of improvement under my charge on June 30, 1901, were:—

- | | |
|--|-------------------------------|
| 1. Lynn harbor. | 8. Town River. |
| 2. Boston harbor. | 9. Scituate harbor. |
| 3. Chelsea Creek. | 10. Duxbury harbor. |
| 4. Mystic River, below mouth of
Island End River. | 11. Plymouth harbor. |
| 5. Mystic and Malden rivers. | 12. Provincetown harbor. |
| 6. Charles River. | 13. Chatham harbor. |
| 7. Weymouth ("Fore" and
"Back") River. | 14. Examinations and surveys. |
| | 15. Wrecks. |

Operations upon these works during the last fiscal year have been as follows:—

Boston Harbor.

Works of preservation: repairs were made to the sea walls on Rainsford and Castle islands.

Works of improvement: 554,503.5 cubic yards of material were dredged, and 3,200 cubic yards of ledge were blasted and removed from the upper main ship channel; and 206,090 cubic yards of material were dredged from Broad Sound Channel.

Mystic and Malden Rivers.

No work was done in the section of Mystic River embraced in this improvement.

In Malden River, 13,576 cubic yards of material were removed during the fiscal year, in restoring the authorized depth of 12 feet at mean high water in the channel.

Mystic River, below the Mouth of Island End River.

From this section of Mystic River, 86,511 cubic yards of material were dredged, giving a depth of 25 feet at mean low water in the channel.

Scituate Harbor.

During the latter part of the fiscal year, 1,583.5 cubic yards of gravel were dredged from a shoal that had encroached upon the dredged channel near the wharves.

Plymouth Harbor.

Construction of the riprap dike on Long beach was continued, and 3,391.5 linear feet were built, containing 12,256.75 tons of stone.

Provincetown Harbor.

Five hundred and fifty-three linear feet of plank bulkhead were built for the preservation of the beach at Abel Hill dike.

Chatham Harbor.

No work was done, but at the close of the fiscal year a contract was in force for dredging a channel 6 feet deep at low water, and at the date of this statement the work has been completed.

Examinations and Surveys.

On Nov. 19, 1900, a report was submitted upon a survey of Lynn harbor, recommending the dredging of a channel 200 feet wide, 15 feet deep at mean low water, at an estimated cost of \$162,936.84. The report was published as House Document, No. 78, fifty-sixth Congress, second session.

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On Nov. 28, 1900, a report was submitted upon a survey of Boston harbor, together with a project for deepening the main ship channel to 35 feet at mean low water from the Charles River and Chelsea bridges to the sea, through Broad Sound, at an estimated cost of \$10,612,710.46. The report was published as House Document, No. 119, fifty-sixth Congress, second session.

No work has been done during the fiscal year in Lynn harbor, Town, Weymouth, Chelsea and Charles rivers, or in removal of wrecks.

Very respectfully,

W. S. STANTON,
Lieutenant-Colonel, Corps of Engineers.

STATEMENT OF CAPT. HARRY TAYLOR, CORPS OF ENGINEERS,
U. S. A.

BOSTON, MASS., Dec. 17, 1901.

Board of Harbor and Land Commissioners, Boston, Mass.

GENTLEMEN:—In accordance with request contained in your letter of the 2d instant, I have the honor to furnish the following summary of the work done by the United States during the fiscal year ending June 30, 1901, in the rivers and harbors of Massachusetts under my charge:—

Newburyport Harbor.

No operations were in progress, other than making a survey of the bar at the entrance of the harbor. This survey shows that there has been some improvement in the depth of water over the bar, the controlling depth in 1901 being 12.6 feet at mean low water, as against 11 feet at mean low water in 1899, when the last previous survey was made. The channel had moved slightly to the north of its 1899 position, but retained about the same width that it had at that time.

Merrimac River.

The present approved project for the improvement of this river provides for a channel 150 feet wide and 7 feet deep at mean low water (ordinary low water stage of the river), from Newburyport to Haverhill. The first work under this project was begun in June, 1901, and at the close of the fiscal year the channel had been dredged 90 feet wide and full depth from a point just below Haverhill for a distance of 1,100 feet down river.

Powow River.

At the beginning of the fiscal year a channel 12 feet deep at mean high water and 45 feet wide had been dredged from the head of navigation at Amesbury for a distance of about 6,050 feet down

river. From this point to the mouth of the river the channel was 30 feet wide. During the past fiscal year the 45 foot width of channel has been extended nearly down to the highway bridge at Salisbury Point, where a section about 650 feet long still remains to be done. This section is at least 30 feet wide.

Essex River.

At the beginning of the fiscal year the channel had been dredged to its full projected depth, 60 feet wide, for a distance of 400 feet below the highway bridge in Essex, and at least 25 feet wide for the remainder of the distance to its lower end. During the fiscal year the project for the improvement of this river was completed, the improved channel now being 60 feet wide and at least 4 feet deep from the mouth of the river up to the highway bridge at Essex.

Harbor of Refuge, Sandy Bay, Cape Ann, Mass.

During the fiscal year operations have been continued in the construction of the substructure of the breakwater. During the year a total of 107,680 tons of rubblestone was placed in the breakwater. The substructure of the southern arm of the breakwater is now completed to mean low water, except for a distance of about 70 feet. A section of about 100 feet of substructure on the western arm was raised to mean low water during the year.

Gloucester Harbor.

At the beginning of the fiscal year a section of about 1,650 feet of the substructure of the breakwater had been completed to full proposed dimensions. The operations of the past fiscal year consisted in the construction of superstructure. The work commenced at the shore end of the breakwater at Eastern Point, and the superstructure was completed for a distance of 284 linear feet. A 3-inch steel spindle for the support of a light, which the Light-House Establishment proposed to maintain, was erected on the outer end of the substructure of the breakwater.

Examination and Survey.

Under the provisions of the emergency river and harbor act approved June 6, 1900, a preliminary examination and survey was made of Beverly harbor, with a view to obtaining a channel 200 feet wide and 18 feet deep at mean low water.

From a survey in 1899 it was found that this harbor possessed an available channel of 18 feet depth at mean low water to the wharves of the town, but the claim had been made recently that this channel had deteriorated materially. The present survey,

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however, made in September, 1900, shows that, while no material shoaling has taken place, the width of the 18-foot channel is so narrow at certain points as to make it difficult to take heavy coal vessels through without touching on one side or the other. It was recommended that a limited amount of dredging be done, estimated to cost about \$10,000, in order to give a clear channel width of about 200 feet.

No work was in progress during the fiscal year on any of the other Massachusetts works in my charge.

Very respectfully,

HARRY TAYLOR,
Captain, Corps of Engineers.

STATEMENT OF MAJ. GEO. W. GOETHALS, CORPS OF ENGINEERS,
U. S. A.

NEWPORT, R. I., Dec. 5, 1901.

Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, State House, Boston, Mass.

GENTLEMEN:— In compliance with your request of Dec. 2, 1901, I forward herewith a summary of work done by the United States during the fiscal year ending June 30, 1901, in the rivers and harbors of Massachusetts.

Very respectfully,

GEO. W. GOETHALS,
Major, Corps of Engineers, U. S. A.

Abstract of the work of river and harbor improvement in the State of Massachusetts by the United States government, under the direction of Maj. Geo. W. Goethals, corps of engineers, U. S. A., for the fiscal year ending June 30, 1901:—

Hyannis Harbor.

No operations have been in progress during the past fiscal year.

This project contemplates the dredging of an area of 36 acres, protected by the breakwater to a depth of 15.5 feet. Of this area, about 26.6 acres have been dredged and two cuts 25 feet wide and 13 feet deep have been dredged in to the wharf of the New York, New Haven & Hartford Railroad Company.

Nantucket Harbor.

No operations have been in progress during the past fiscal year.

This project contemplates the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal currents to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging where necessary to obtain a depth of from 12 to 15 feet

at low water in this channel. The west jetty has been built for a distance of 4,955 feet, and the east jetty 4,840 feet, from the initial points on shore. Portions of both jetties are still to be built up to their projected cross-sections. There is now a depth of 8 feet in the channel, which, before improvement, was limited to 6 feet.

Vineyard Haven.

No operations have been in progress during the past fiscal year.

An examination of the harbor, with a view to its further protection and improvement as a harbor of refuge, by a breakwater, or otherwise, was made in September, 1899, and report thereon submitted to Congress, and printed as House Document, No. 66, fifty-sixth Congress, first session; it was also printed at page 1289, Annual Report of the Chief of Engineers, for 1900. In this report it is recommended that Congress be asked to authorize a general investigation of the question of a harbor of refuge for Vineyard and Nantucket sounds, with a view to determining the best location for such a harbor.

Wood's Hole Channel.

No operations have been in progress during the past fiscal year.

The existing project provides for deepening the channel through the strait to 13 feet at mean low water, and widening the same to 300 feet. There is now a fairly good channel of one-half the projected width, 150 feet and 13 feet depth through the strait; but a few shoal spots west of the junction of the two branches of the channel need to be removed to complete the southern half of the channel.

New Bedford Harbor.

No operations have been in progress during the past fiscal year.

The existing projects provide for dredging an anchorage basin $\frac{1}{2}$ mile long, 600 feet wide and 18 feet deep at mean low tide, on the north side of the channel leading from Fairhaven to New Bedford; also for dredging a channel 250 feet wide and 18 feet deep from the anchorage basin through the new drawbridge between Fish and Pope's islands, to the deep water above. About .6 of the anchorage basin has been dredged; also the entire channel leading through the drawbridge; but, owing to the very soft character of the material through which the latter was dredged, the full depth has not been maintained throughout its width.

Eighteen feet of water may now be carried from the deep water of Buzzards Bay through the drawbridge.

Taunton River.

No operations were in progress during the past fiscal year.

The existing project contemplates dredging a channel so that it shall have a width of 100 feet and depth of 12 feet from the mouth of the river up to Berkley bridge; thence 12 feet depth and 80 feet width up to Briggs shoal; thence 11 feet depth with the same width up to the ship yard; thence 11 feet depth with 60 feet width up to Weir bridge, the depths all being referred to mean high water. This project is essentially completed, but there are a few points at which the channel requires widening.

Fall River.

No operations were in progress during the past fiscal year.

The existing project provides for a channel 300 feet wide and 25 feet deep at mean low water, along the city front between the deep water just below the Old Colony wharf and the deep water at the upper end of the harbor. The lower reach of this channel, extending from its lower end up to the Staples Coal Company's wharf, and comprising about one-half of the projected work, has been completed.

Removal of Wrecks.

During the fiscal year, the following wrecks were removed, so as no longer to form obstructions to navigation.

Schooners "Laura Robinson" and "David Siner" from the vicinity of Pollock Rip Light Ship, and the British steamer "Ardanhu" from Vineyard Sound near Robinson's Hole.

HARBOR COMPENSATION FUND.

There was paid into the treasury of the Commonwealth during the year, under sections 14 and 16 of chapter 19, Public Statutes, and chapter 146, Acts of 1897, in payment for tide water displaced by work done under licenses granted by the Board, and for rights and privileges granted in tide waters and great ponds, the sum of \$29,475.11, which was credited to the harbor compensation fund for Boston harbor. The amount in this fund on Nov. 30, 1901, was \$357,864.66; the income from this fund on the same date was \$19,891.47.

COMMONWEALTH'S FLATS IMPROVEMENT FUND.

The balance in the Commonwealth's flats improvement fund on the first day of December, 1900, was \$622,830.65. To this has been added during the year \$22,781.56 from the income of the fund and \$30,282.55 from sales and rents of lands and other sources, making a total of \$675,894.76. Of this sum, there has been expended during the year \$70,598.51, leaving a balance on Nov. 30, 1901, of \$605,296.25.

TAUNTON RIVER AND BOSTON HARBOR CANAL.

Chapter 104 of the Resolves of 1901 directed the Board to make surveys and estimates as to the probable cost of constructing a ship canal from Narragansett Bay through Taunton, Brockton and Weymouth to Boston harbor, by way of Weymouth Fore River, and to report thereon to the General Court now sitting.

The depth and width of the proposed canal were apparently left to the judgment of the Board. A uniform depth of 25 feet and a width of 130 feet on the bottom, with side slopes of 1 on 2 in earth, and 180 feet with vertical sides where rock is encountered, have been fixed for the dimensions of the trunk of the canal.

A general location was determined from a study of the topographical maps, base lines were run, and a topographic and hydrographic survey was made for a distance of not less than 500 feet on either side for the entire distance from Weymouth Fore River to Slade's Ferry bridge near the mouth of Taunton River, with levels on the same and on cross-sections 500 feet apart. Other necessary levels were run and tidal observations made. The plane of reference of the survey was established at 1.5 feet below the mean sea level at Boston.

The results of these surveys were plotted on large scale plans, and contours drawn, showing every difference of 2 feet in elevation over the area surveyed. After a careful study of the information accumulated, a route was finally adopted.

The total length of the canal upon which the estimates

are based between the ends of the approach structures of the tidal locks is 31.79 miles, of which 7.24 miles are on curves, the radii varying from 5,000 to 10,000 feet, and 2.22 miles of shorter radii, none, however, less than 2,000 feet. In fixing the line, due regard was had to economical construction.

Provision is made for 14 locks, 6 between Boston harbor and the summit level and 8 between there and the dam in Taunton River, with lifts varying from 7 to 25 feet. On the basis of 20 lockages a day, 33,000,000 cubic feet of water will be required for the daily operation of the locks.

A careful examination of the water supply and of the different methods of providing the necessary amount of water led to the adoption of a pumping system, as being the most advisable. The water surface of the summit level lies between Brockton and Randolph. The summit level is 16,000 feet long, at an elevation of 130 feet.

Two masonry dams are planned at the two ends of the canal, across Taunton River and Weymouth Fore River, respectively, opposite the tidal locks, to maintain the water in the rivers at high tide level.

The proposed line of the canal crosses the railroad at eleven places; it is proposed to avoid five of these by diverting the location of the tracks, and two of the others are drawbridges at the present time. It also crosses forty-six highways, of which a number are avoided by a rearrangement in such manner that the distance to be travelled will not be materially increased. Twenty drawbridges will cross the canal in most of which a clear width of 100 feet is provided for the passage of vessels.

Wherever the water level of the canal rises above the adjacent country, the side embankments are planned with puddle walls of clay; but where it runs through earth, a protection of broken stone, extending from 5 feet above to 5 feet below the water level, will be provided. Turning basins are proposed at Taunton, Brockton and Holbrook, approximately 600 feet square.

The cost of a sufficient right of way has been estimated. All estimates are based on unit prices, carefully considered;

and yet allowance must be made, owing to the brief time permitted for the examination of so large an undertaking. The total cost is estimated at \$57,618,358.

A full report by the engineer * of the Board, together with plans of location and profile, may be found in the Appendix.

The foregoing report is respectfully submitted.

WOODWARD EMERY,
CHARLES C. DOTEN,
GEORGE E. SMITH,
Commissioners.

Dec. 1, 1901.

* See Appendix D.

THE
UNITED STATES
DEPARTMENT OF
THE ARMY
AND
NAVY

APPENDIX.



APPENDIX.

[A.]

[See page 4 of this report, *ante*.]

CONTRACTS.

The contracts entered into during the year are as follows : —

1901.		
Feb. 14.	With the Bay State Dredging Company, for dredging in Fort Point Channel, Boston harbor, between Congress Street bridge and Rowe's wharf, for the sum of 25 cents per cubic yard of material, measured in scows, — amounting to	\$14,317 25
March 7.	With William J. Lawler, for building a sea wall on the Commonwealth flats, at South Boston, for the sum of \$56.49 for each lineal foot of completed sea wall, — estimated to amount to	76,300 00
April 20.	With the Harries & Letteney Company, for dredging in Plymouth harbor, near Long beach, for the sum of 28½ cents per cubic yard of material, measured in scows, — amounting to	797 72
May 16.	With the Bay State Dredging Company, for dredging in Shirley Gut, Boston harbor, for the sum of \$1,000, and in addition the sum of 35 cents for each cubic yard of material, measured in place, dredged and deposited on the Commonwealth pier at South Boston, — amounting to	5,429 60
May 31.	With Thomas Meany, for moving and grading gravel on the Commonwealth pier, at South Boston, for the sum of 30 cents for each cubic yard of material moved, measured in the fill, — amounting to	3,796 80
July 16.	With George H. Cavanagh, for dredging a portion of Lake Anthony, at Cottage City, and setting buoys, — amounting to	2,500 00
July 30.	With Thomas H. Kiely, for furnishing riprap stone on the bank of the Connecticut River, at Hadley, for the sum of \$1.67 for each cubic yard of stone delivered, — amounting to	5,888 09

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1901.

Sept. 6.	With the Eastern Dredging Company, for dredging a portion of the dock on the westerly side of the Commonwealth pier, at South Boston, for the sum of 22½ cents for each cubic yard of material, measured in scows,—estimated to amount to	\$15,500 00
Sept. 17.	With Eugene S. Belden, for strengthening the jetties built under the direction of the Board, at Osterville, for the sum of \$2.47 for each ton of stone placed in the work,—amounting to	2,964 00
Nov. 14.	With Augustus Bellevue & Co., for building jetties and dredging channel at the mouth of Bass River, in Dennis and Yarmouth,—estimated to amount to	20,307 60
Nov. 22.	With the New England Dredging Company, for dredging in Boston harbor, near Union wharf, for the sum of 32½ cents for each cubic yard of material measured in scows,—amounting to	4,217 53
Total amount,		<u>\$152,018 59</u>

[B.]

[See page 26 of this report, *ante*.]REPORT OF ENGINEER IN CHARGE OF CONNECTICUT
RIVER WORK.

To the Honorable Board of Harbor and Land Commissioners of Massachusetts, WOODWARD EMERY, Esq., Chairman.

GENTLEMEN:—Following the instructions and authority given me by your vote of July 11, 1901, in carrying out the provisions of chapter 94 of the Resolves of 1901, relating to the further protection of the easterly bank of the Connecticut River in the town of Hadley, I have completed the season's work therein contemplated, and submit the following report thereon:—

The section of river bank protected by this year's operations extends from the northerly end of the section treated in 1900, up the river to Coleman's Brook, so called, a distance of 1,455 feet:

The plan adopted last year, at the suggestion of your engineer, Mr. Hodgdon, of a continuous matting of poles and willows, interwoven for the submerged part of the work, has been followed this year, with very satisfactory results. A description in detail of methods employed seems unnecessary here, as it would simply be a repetition of what has already been given in former reports.

The contract for stone for riprapping, made by you with Thomas H. Kiely of Northampton, has been faithfully carried out on his part, the stone having been delivered promptly, and of the required dimensions.

The quantity delivered was 3,525.8 cubic yards, at a cost of \$5,888.09.

Active operations were commenced July 15, and the work completed November 5.

The area covered by mats and riprapping is 19,989 square yards, and the total cost has been \$10,660.78, which is 53½ cents per square yard. The above total includes surveys, plan and estimate for a proposed dike below the highway bridge over the river between Hadley and Northampton.

The protective work has been carried into the ravine of Coleman's Brook a sufficient distance to prevent any damage to the banks by the action of waves or currents of the river. Proper

connection has also been made at the lower end of this season's work with that completed in 1900.

With but one or two exceptions, local help has been employed on the work, under the immediate supervision of Roswell S. Gaylord, whose recognized ability and good judgment have contributed largely to the economical prosecution of the work.

The scows and lumber used on the work are piled up and roofed over on land of C. P. Wood, at the head of Front Street. The tools, tool box, ropes, etc., are housed in R. S. Gaylord's barn.

You will undoubtedly direct that young willows be set in this season's work at a suitable time next spring to complete the work, as has been done in years past.

The protective works built from year to year under your direction are now completed from the head of Front Street, in Hadley, around the "high banks," so called, to Coleman's Brook, a distance of 5,100 feet, and afford a continuous line of protection for the main part of the town from further encroachments of the river between the points named. Above and below these points there is no pronounced erosion of the banks, and I am confident that no further expenditures will be necessary for years to come on this part of the river.

The inhabitants of the town of Hadley fully appreciate the work that has been done for them, under your supervision, for the protection of the business part of their town, and the danger, so long manifest, by the yearly encroachments of the river at the head of their principal streets, it is believed, has been successfully met and overcome.

A serious break occurred in the river bank, below the highway bridge above referred to, during the high water of last spring. In company with your Mr. Hodgdon, this matter was examined, together with its probable effect on the adjacent lands, and a dike was suggested, extending from the highway to the river bank, as a preventive of further damage at this place. Surveys have been made for this dike, and a plan and estimate of the cost were submitted to you July 27, 1901. If it is decided to build this dike another year, the town of Hadley will undoubtedly take the necessary steps to secure a title to the land where it is proposed to locate it, and the material with which to build it.

Respectfully submitted,

E. C. DAVIS,
Engineer and Superintendent.

NORTHAMPTON, MASS., Nov. 9, 1901.

[C.]

[See page 82 of this report, *ante*.]REPORT OF THE SUPERINTENDENT, PROVINCE
LANDS.

PROVINCETOWN, MASS., NOV. 30, 1901.

To the Board of Harbor and Land Commissioners.

GENTLEMEN:—As Superintendent of the Province Lands, I respectfully submit the following report for the year ending Nov. 30, 1901:—

The first work of the season, about the middle of March, was the construction of a road, beginning at the point to which it had been built up to the close of the season of 1900, and continuing the same to its terminus at the outer beach of the reservation, a distance of about 1,900 feet, at a cost of \$745 or about 40 cents per running foot, the increased cost over that of last year being on account of the greater distance to cart the material.

This road makes a very acceptable driveway across the reservation, a distance of about 2 miles, or, by connecting with the town road from the harbor front to the outer beach, about 3 miles. It is very convenient for the people of Provincetown and others who wish to go to and from the outer beach and life-saving stations, and has been extensively used by many summer visitors. It has remained in remarkably good condition for a sod road, considering the amount of travel which has passed over it. The first section of the road, built in the spring of 1894, is still in good condition, and has required but little work and attention.

The same method of checking the drifting of the sands and of reclaiming the lands has been followed; namely, the transplanting of beach grass for a sand binder, and the planting of trees, shrubs and seeds of various kinds, principally pines and bayberry (*Myrica cerifera*).

The transplanting of beach grass began about the middle of May, and continued, as weather permitted, until June 5, when this work was suspended. It was resumed about the middle of September, and continued until November 20, the total area covered during the season being about 20 acres. Owing to the excellent results obtained from the use of bayberry on ground already

covered, it was considered advisable to introduce this shrub simultaneously with the grass; and, although a smaller territory was covered, permanent results were obtained.

As in past seasons, a large number of young pines taken from the woods and bogs have been transplanted along the foot of the slopes, and pine seeds planted on the flat grounds between the ranges of sand dunes.

The weather conditions during the entire season have been very favorable, and, as a consequence, a very marked improvement in the work of the past and present seasons is observable, the grass-plants, trees and shrubs having made a vigorous growth.

Notwithstanding the fact that during the last two months there have been some very strong winds, yet the planted territory remains intact, and no movement of sand from these sections is observable.

About 170 acres of the exposed slopes have been covered since the spring of 1895. An additional area of about 115 acres should have immediate attention, and when this is covered, a comparatively small outlay only will be required to keep the same intact.

Respectfully submitted,

JAMES A. SMALL,
Superintendent of the Province Lands.

[D.]

[See page 111 of this report, *ante*.]REPORT OF ENGINEER ON TAUNTON RIVER AND
BOSTON HARBOR CANAL.

BOSTON, Jan. 20, 1902.

*To the Board of Harbor and Land Commissioners, State House, Boston,
Mass.*

GENTLEMEN:—In accordance with your instructions, I have had surveys and estimates made as to the probable cost of constructing a ship canal from Narragansett Bay to Boston harbor through Taunton River and Weymouth Fore River, under chapter 104 of the Resolves of 1901:—

Resolved, That the board of harbor and land commissioners is hereby directed to make or cause to be made surveys and estimates as to the probable cost of constructing a ship canal beginning at some convenient point on Narragansett bay and Taunton river, harbor or estuary thereof, and extending across the state of Massachusetts through the cities of Taunton and Brockton and the town of Weymouth to Boston harbor by way of Weymouth Fore river. For this purpose the board may employ an engineer or engineers and other assistants, and may expend a sum not exceeding ten thousand dollars. The board shall report to the general court not later than the fifteenth day of January in the year nineteen hundred and two. Whatever amount is expended by the board for the purpose authorized by this resolve shall, in the event of the granting of any charter or franchise for the construction of a canal between the points above specified, be repaid to the Commonwealth by the grantee or grantees of such charter or franchise. [Approved June 13, 1901.]

The statute simply provides for the surveys and estimates for a ship canal, without in any way indicating the size of ships to be provided for; but it limits the location by providing that it shall pass through the cities of Taunton and Brockton and through the town of Weymouth.

The plan adopted for the investigation is as follows: First, to determine the general character and dimensions of the canal, and where it could probably be located. Then the field surveys were undertaken, under the general supervision of Mr. Henry B. Wood, with Mr. Eugene E. Pierce, Mr. A. D. Butterfield and Mr. L. H. Bateman in immediate charge of the different survey parties; and

in the office Mr. John R. Burke, Mr. W. W. Marrs, Mr. T. W. Bailey and Mr. E. W. Hadcock were employed in the preparation of the plans and estimates, the field note books being sent to the office, and the plans prepared as soon as the books could be spared from the field work.

Mr. F. W. Dean, Mr. S. E. Tinkham, Mr. Henry D. Woods and Mr. E. L. Brown have made estimates and examinations as to pumping, machinery, bridges, mechanical lift locks, and the nature of the soil through which the canal is to be constructed.

Upon the completion of the field surveys, Mr. D. J. Howell, who had been engaged as assistant engineer on the surveys and in preparing the report of the United States Board of Engineers on deep water ways from the Great Lakes to the Atlantic coast, and as consulting engineer in charge of the surveys and estimates for a barge canal from the Great Lakes to the Hudson River, under the direction of Hon. Edward A. Bond, State engineer and surveyor of New York, was engaged to assist in the preparation of the plans and estimates. Mr. Howell brought to the work a great fund of information collected during his work on the New York investigations, and to this is due much of the completeness of this report; as, owing to the limited time after the completion of the field work, it would otherwise have been impossible, with the small appropriation available, to prepare the necessary plans and estimates, — and, as it is, much is lacking, owing to our inability, through lack of means, to make borings and do other work necessary to obtain a complete knowledge of the facts.

My first endeavor was to determine the size of the canal which was required, and at my request you addressed a letter to Mr. Parker C. Chandler, who had been prominent in advocating the passage of the resolve through the Legislature, asking him for any information he had bearing on the subject under investigation, and also as to the size of the canal desired by the petitioners. In his reply he stated that considerable information might be obtained from documents in the State Library, and referred to the report of the committee of the Legislature who explored a line for a canal over this route, and made a report on the same in February, 1808. He also stated that reports had been made by officers of the general government on the same subject; and a copy of a report made by the Board of Internal Improvement and transmitted to Congress by the Secretary of War on Feb. 16, 1825, on the proposed canal from Barnstable Bay to Buzzards Bay, and also on a general examination of the route from Narragansett Bay to Boston harbor, has been found. This report stated that a general and thorough survey of this route appeared to be wanting.

A copy of a portion of a plan made by the United States Topographical Engineers in 1833, from a detailed survey of the portion of the route from Boston harbor to Brockton, has also been found; but the report of the engineers on this survey we have not been able to find up to the present time, although search has been made for it in the State Library and at the office of the Chief of Engineers at the War Department at Washington.

In regard to the size of the canal, Mr. Chandler stated that it was the intention of the petitioners to have that matter left open, so that the commissioners would study the matter and decide as to the size of the canal which would be required by modern vessels. He also stated that the general government had comprehensive plans for a scheme of inland navigation stretching along the coast line from Boston harbor to Florida, and the line from Boston harbor to Narragansett Bay was one link in this scheme. He also called attention to the various forms of mechanical lifts which had been designed and in some cases put in successful operation to take the place of the ordinary canal lock; and also to the modern machinery which had been designed for the construction of canals, thereby greatly reducing their cost, and also stated that the project for this canal would be called to the attention of the next Congress. He promised at the same time to forward several books, documents and maps which would be of service, but he was unable to do so.

As his letter did not give information as to the size of the canal required, in seeking other sources of information as to this question, letters were addressed to the Secretary of the Navy and the Secretary of War, asking what plans the government had in relation to water ways along the Atlantic coast, and especially between Narragansett Bay and Boston harbor, and as to the size of any proposed water ways in this location, also for such opinions as might have been expressed by any of the officers of the Engineer Corps or of the Navy as to the dimensions which such a water way should have.

The Secretary of the Navy in replying simply stated the dimensions which had been adopted in 1884 for a projected canal from Barnstable Bay to Buzzards Bay, and the dimensions of the Kaiser Wilhelm Canal and the Suez Canal, stating that this was all the information on file in the department which it was deemed would be of value to us.

The letter to the Secretary of War was referred to the Chief of Engineers, and in his reply he stated that no plan had been formed by the federal government for a system of internal water ways along the coast from Maine to Florida, but that a number of inland

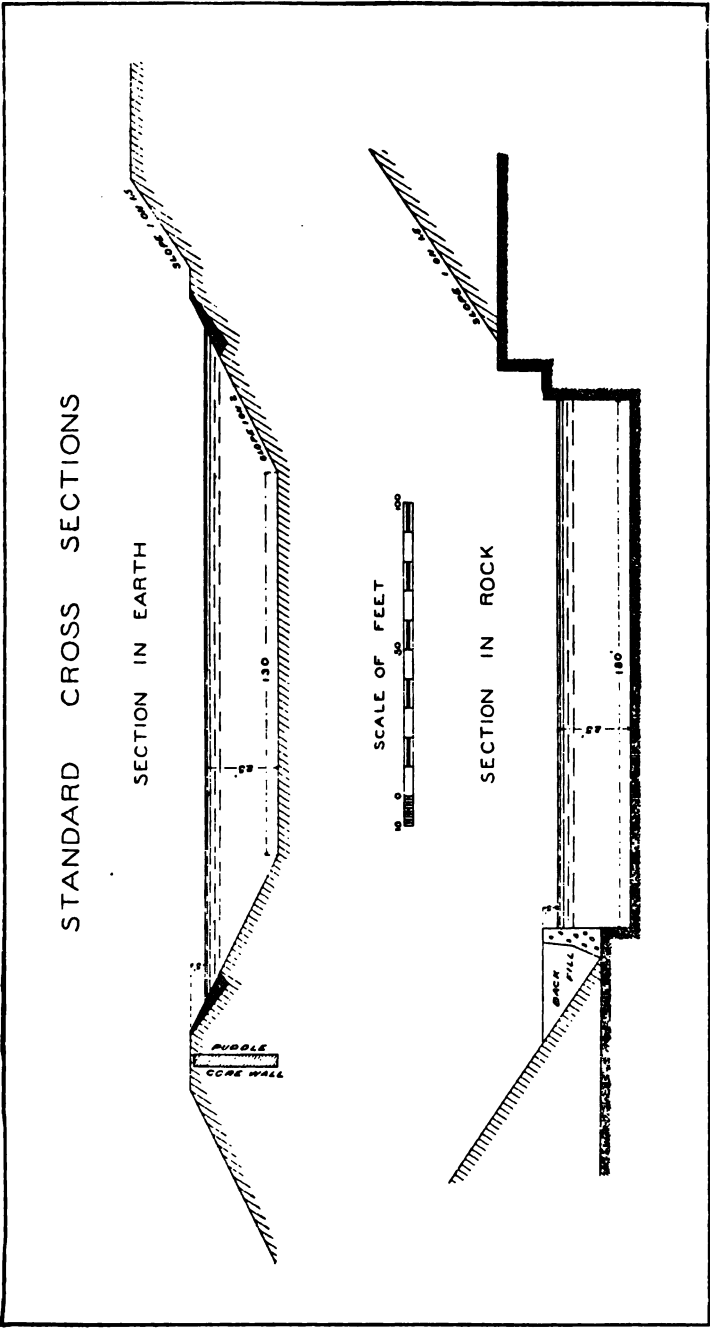
routes are being improved, under appropriations made by Congress, between Delaware Bay and Florida, and that surveys for others within the same limits had been made, and forwarded copies of the latest reports on these works. On examination of these documents, it was found that all the water ways now under improvement are for light-draft vessels, and the only information as to such a ship canal as is proposed in the case under consideration was in a report made in 1894 on a survey for the Chesapeake and Delaware Canal, which was to connect Baltimore harbor with deep water at the mouth of the Delaware River. This was to be a canal 100 feet wide on the bottom and 26 feet deep at low water.

In view of the fact that the statute incorporating the Boston, Cape Cod & New York Canal Company, in 1899, fixed the dimensions of this canal as depth 25 feet and bottom width not less than 100 feet, it was decided that it would not be wise to adopt any smaller dimensions. A depth of 25 feet is sufficient to float the vessels engaged in the coastwise traffic, and, with the width of 60 feet in the locks, any of the naval vessels, except battle ships, could pass through.

In order that the canal shall have sufficient cross-section to enable vessels to pass through at a fair rate of speed, the width has been made 180 feet on the bottom, with the side slopes 1 on 2, for all sections where it is expected earth will be found; but where rock is encountered, the section will be 180 feet wide, with vertical sides. This gives cross-sections about four times greater than the midship section of the largest vessel which could safely navigate a canal of this depth, and is about the same as that of the Manchester Ship Canal. In this width the ordinary coastwise steamers could safely pass in any place with only a slight reduction in their normal speed through the canal.

Having fixed the dimensions of the trunk of the canal, search was made for an approximate location, using the plans of the State topographical map. A study was made on this map of the different lines which had been suggested at different times by various parties, among them the lines shown on the lithograph plan presented to the Legislature by Mr. Chandler, and the two lines surveyed by the United States Topographical Engineers between 1821 and 1833.

All the lines surveyed along this general location except the present scheme have been for small barge canals, and it was found that the general course followed by these would be the best for the proposed ship canal. In general, the line selected starts in Weymouth Fore River, a short distance above the bridge at Quincey Point; thence follows the valley of the river to Weymouth land-



ing; thence up the valley of Smelt Brook a short distance, crossing the south shore branch of the Old Colony Railroad at Weymouth landing and the main street of the town close to the East Braintree boundary line; thence continuing up the brook and through the divide into the valley of the Monatiquot River; thence following up this valley, crossing the Plymouth, & Whitman branch of the Old Colony Railroad and the present main line of the Old Colony Railroad just south of the South Braintree station; thence across Dyer hill, following along the Cochato meadows and crossing the Taunton branch railroad opposite Mayflower Park, and the line of the Cape Cod branch railroad about 3,000 feet north of Holbrook station; thence keeping a short distance east of the railroad and passing through the divide near Avon station into the valley of Trout Brook, and along the valley of this brook and Salisbury Plain River through the city of Brockton, crossing the Middleborough section of the Plymouth division of the New York, New Haven & Hartford Railroad a little south of Campello station; thence through the divide between the valley of the Salisbury Plain River and Town River, crossing the West Bridgewater branch of the Old Colony Railroad; thence along the valley of Town River, passing through Hockanock swamp, Nippinicket Pond, and the divide into the valley of the next stream south, a tributary of the Taunton River, which runs through the village of Raynham; thence down the valley of this stream and the Taunton River to Weir village in the city of Taunton, and thence following the Taunton River to its mouth in Mount Hope Bay.

The general location having been determined from the study of the maps, two parties were organized for making a detailed survey of the location. Base lines were run and the topography and hydrography surveyed the whole distance from Weymouth Fore River to Slade's Ferry bridge near the mouth of Taunton River. In general, the base line followed the line of the proposed canal, and the topography was surveyed for a distance of not less than 500 feet on either side of the line. The angles in the base line were connected with the triangulation stations of the town boundary survey, and in this way the whole work was checked and errors avoided. At a number of places where there appeared to be a choice as to the best location, the surveys extended over a considerably greater width.

Levels were run the whole length of the base lines, and on cross-sections every 500 feet; these levels furnished points from which the topographic parties could check their work. In addition, a line of precise levels was run from Somerset to Weymouth landing, following the line of the railroad and highways, connect-

ing at frequent intervals with the line of levels run along the base lines. At the same time, tidal observations were made at both ends of the canal, and compared with the benches of the United States Coast Survey. From these levels, adopting the mean sea level calculated from the observations of the Coast Survey at Boston, it was found that the plane of reference of the survey was 1.5 feet below mean sea level at Boston, while the mean water level at Somerset was a few tenths of a foot higher than that at Boston, due probably to its distance up the river from the sea.

The difference in elevation of the various benches, as determined by the line of precise levels and the line run over the base line, did not vary at any point more than .3 of a foot. Many bench marks were established along the line of these levels, which will probably be found useful in future work. The results of these surveys have been plotted on a series of 24 sheets, each 30 by 52 inches, on a scale of 1 to 2,000, and one sheet about the same size on the scale of 1 to 5,000. On the large scale sheets contours were drawn showing every 2 feet difference of elevation, and on the sheets thus prepared the centre line of the proposed canal was located.

A diligent inquiry was made for information as to borings which had been made for any purpose along the line of the proposed canal, and as to the character of the material through which the wells in the vicinity had been dug or driven, also the same information in relation to other excavations. The outcrop of all ledges along the line of the survey were located by the survey parties; so that, although unable to make any borings of our own, sufficient information was obtained to give a very fair idea of the character of material to be excavated, and on what material the various structures would probably be founded.

Information furnished by the city engineers of Brockton and Taunton and by Mr. Edward Parrish of the United States Engineer Office at Newport was of much value in this part of the investigation, and other parts of the work were very much facilitated by using the plans and data furnished by them and others.

South of Brockton, in addition to the route finally adopted, surveys were made over a route crossing the divide to the west of Campello station, and following down the valley of Black Betty and West Meadow brooks, rejoining the original route at Skimilk bridge, a short distance north of Nippinicket Pond. This route would have avoided the necessity of going directly through the village of West Bridgewater, but after considering the two, the easterly one was adopted as preferable. At the northern end an alternative route from South Braintree to the Weymouth Fore River was to follow the valley of the Monaquot River from South

Braintree to Braintree; thence across the country to a point in Weymouth Fore River just south of the new works of the Fore River Ship and Engine Company. On the maps this appeared to be quite feasible, but, as it did not enter the town of Weymouth, as is required by the statute, it was not surveyed.

South of Taunton the line follows the general location of the Taunton River; but, owing to the sharp curves in the river, it was found necessary to cut through the bends in many places in order to get such an alignment as would enable large steamers and barges to safely navigate the new channel. It is planned to establish tidal locks at each end, the one in the Taunton River to be located just north of the village of Dighton, and the one at Weymouth Fore River on the westerly bank of the river, about opposite the northerly end of White's Neck. Between the tidal locks are 12 other locks, with lifts varying from 16 to 25 feet.

Alignment.

The total length of canal on which the estimates are based between the ends of the approach structures of the tidal locks is 31.79 miles; of this, 22.33 miles is straight, and the balance, 9.46 miles, on curves of radii varying from 2,000 to 10,000 feet, only 2.22 miles having radii of less than 5,000 feet.

On all curves of less than 10,000 feet radii the width of the canal was increased by an amount determined by the following formula: $60 - .005 \times \text{radius}$, all dimensions in feet, the additional width being added one-half on each side at the middle of the curve, and tapered to nothing at the tangent points.

The canal line was located where, from all the information obtained, it appeared that the canal could be most economically constructed within the limits prescribed by the resolve. Further investigations and borings to determine the character of the material through which it is to be built and on which the various structures are to be founded will undoubtedly show the advisability of some changes in the location of the canal and its various structures; but any changes which are liable to be made will not, in all probability, materially alter the total cost.

Northern Approach.

At the northern end of the canal deep water is found at the mouth of Weymouth Fore River, about $2\frac{1}{2}$ miles below the bridge at Quincy Point. This channel is the approach to the works of the Fore River Ship and Engine Company; and in making the estimates it has been assumed that it would be enlarged and deepened by the general government as an approach to these

works, and the cost of doing this work has not been included in the estimates for the canal.

Between the bridge and the tidal lock (a distance of about 1 mile) the estimates are for a channel substantially 500 feet wide and 25 feet deep at mean low water, the width being much greater than at any other portion of the canal, owing to the very sharp curves which it is necessary to introduce.

The most natural location for the purposes of navigation would have been to excavate a channel across the neck of land known as Old Spain, which would have given practically a straight channel from the mouth of the canal into the lower part of Weymouth Fore River. No estimates have been made for this, as it did not seem that the increased facilities for navigation would be sufficient to justify the greatly increased cost.

The plans of the general government for the improvement of the Weymouth Fore River are simply to obtain a channel from a point about opposite the proposed entrance lock of the canal up to the head of navigation, not less than 6 feet deep at mean low water, and of a width varying from 100 feet to 50 feet. This has been substantially completed, and no plans have been adopted for any further improvement.

Southern Approach.

At the southern end of the canal deep water is found in Mount Hope Bay just below the point where the line between Massachusetts and Rhode Island crosses it. Above this in Fall River harbor and between Fall River and Somerset there are long sections where the channel is more than 25 feet deep for a width of not less than 300 feet, but there are bars crossing it at a number of places. The plans of the general government contemplate the excavation of a channel 25 feet deep at mean low water and 300 feet wide through these bars up through Fall River harbor to Slade's Ferry bridge. From this point nearly up to Somerset, a distance of 3 miles, the channel is continuous, and of sufficient width and depth; from thence up to the entrance lock, a distance of 4.5 miles, the channel will have to be excavated to a depth of 25 feet at mean low water with a width of 300 feet. The plans of the general government at present contemplate the deepening and widening of the channel so as to secure a depth of at least 12 feet at high water, with a width of 100 feet up to Berkley bridge; thence the same depth and 80 feet wide up to Briggs shoal; thence 11 feet in depth with the same width up to the ship yard; thence 11 feet depth with a width of 60 feet up to Weir bridge at Taunton. These plans have been practically completed. The work remaining to be done

consists of the removal of a small amount of ledge and some dredging below Berkley bridge. In making the estimates it has been assumed that the general government will carry out its plans and excavate the channel up to Slade's Ferry bridge, and the estimates include only the work of dredging the channel from the deep water below Somerset to the tidal lock.

Style of Lock.

In a canal of this size the question of the water supply is a very serious one, especially in a flat country, where the drainage areas tributary to the canal, especially those above the elevation of the summit level, are not large.

The ordinary form of lock to accommodate vessels of the size which may be expected to use a canal in this location requires the discharge of a very large volume of water from the upper level into the lower level whenever a vessel passes from one to the other. This loss from the upper level must be supplied from some source. In order to avoid the necessity for such a great loss of water, various mechanical devices have been designed. Many of these have been used on barge canals, but I know of no case where they have been used on a canal as large as the one now under consideration. In addition to the saving of water, these mechanical appliances are designed to be used for much higher lifts than the ordinary lock, so that each one will take the place of a number of the ordinary type, with a corresponding decrease in the length of time required for a vessel to pass from one level to another.

These mechanical appliances are of different types. The earliest, known as chain lifts, consisted of a wooden or metal box with gates at each end, filled with water, and large enough to contain the largest boat using the canal. To this were attached a number of chains which passed up over pulleys mounted on framework, the other ends of the chains being connected with counterweights sufficient to counterbalance the weight of the box full of water. After the boat was placed in the lock and the gates closed, sufficient water was either drawn into or from the box to make it heavier or lighter than the counterweight, so that it would either drop or rise, as required, to the other level of the canal.

Next come the various kinds of hydraulic lifts. These also consist of boxes or tanks sufficient in size to contain enough water to float vessels using the canal, and they are raised or lowered by hydraulic rams, which are either placed directly under the box or alongside it; in the latter case, the ends of the rams carry large pulleys over which pass chains or wire ropes, one end of which is

attached to the press of the ram, the other to the side of the lock. These are ordinarily constructed in pairs.

The third form is the floating lift, which consists of one or more tight tanks floating in a deep pit, and supporting above them on trestle work the box of the lock. The floats being submerged, it requires the application of a small amount of power to raise or lower the lock.

The fourth form is the pneumatic lock, which consists of an inverted tank in a pit filled with water. On the top of this tank is the ordinary lock box, with gates at the ends, filled with water. These locks are designed to be used in pairs, the two inverted tanks being connected by large pipes, and the air passing from one to the other as the locks are raised and lowered, one rising as the other lowers.

The first three styles have been used in various forms in this and European countries, but so far as I have been able to learn, the pneumatic lifts have not been in use as yet.

Mr. Woods's notes, describing the various lifts which have been designed or built, are hereto annexed.* From the results of this study, and as the heights of the lifts in the canal under consideration are well within the range of work which has already been constructed, and as the construction of mechanical lifts of this size would be somewhat of an experiment, none having actually been constructed, it has been decided that for the purpose of this estimate it will be better to provide for using the ordinary style of lock.

Water Supply.

Having decided to base the estimates on the ordinary style of lock, the question arises as to where the necessary water supply can be obtained.

The number of vessels arriving at Boston from southern ports in 1900, as stated in the annual report of the Boston Chamber of Commerce, is as follows: tugs, 1,235; steamers, 1,083; barges, 2,817; total, 5,135, — an average of about 14 per day. If these all came and returned through the canal and passed through the locks singly, it would make 28 lockages per day; but, as the arrivals are not regular, and the locks being large a number can pass through at one lockage, it has been deemed best to assume 20 lockages per day of the full-sized locks as a basis on which to calculate the supply of water required. All of the locks north of the summit level of the canal except the tidal lock have lifts of practically 25 feet each. The locks south of the summit

* Not printed.

level vary from 16 feet to 21 feet lift, and, on the basis of 20 lockages each day, it will require 30,000,000 cubic feet of water daily to operate the locks.

As the canal is located so as to be generally below the ground-water level of the surrounding country, the loss of water from seepage would probably not be large. To provide for this and for the leakage through the lock gates and culverts, it is estimated that 3,000,000 cubic feet per day will be required, making the total amount of water required 33,000,000 cubic feet per day.

There is no drainage area near the location of the canal which will supply such a large quantity of water at an elevation above the summit level, and such small portions as are at the necessary elevation are largely used at the present time in supplying the population in their vicinity with water for domestic use. The stream which most nearly meets the required conditions is the Blackstone River. This has a drainage area above the dam at Millville in Blackstone of 258 square miles; and, if all the water from this drainage area can be intercepted and stored, it would nearly supply the demands of the canal, on the basis of 20 lockages per day of the full-sized locks. The river at Millville is about 70 feet above the summit level of the canal, — a sufficient elevation to enable the water to be diverted into it.

An aqueduct capable of conducting the water would be about 30 miles long, and would have to be built very largely in tunnel. It would be very nearly straight, and would pass along the southerly side and near the summit of the main divide, separating the streams which flow northerly into Boston Bay and southerly into Narragansett Bay, crossing nearly all the valleys which it intersects substantially at right angles.

Owing to the configuration of the country, it would be difficult and expensive to construct reservoirs to store all the water on this water-shed. For this reason, another method of furnishing the water supply was investigated, viz., to pump it from the Weymouth Fore River at the northern end of the canal up into the summit level. For this purpose four sets of pumps would be required: one set to pump from the river directly into the level above lock No. 3; another set to pump from the level below lock No. 4 into the level above the same lock; the third to pump the water from the level below lock No. 5 to the level above the same lock; and the fourth to pump from the level below lock No. 6 into the summit level.

Owing to the large quantity of water to be raised, the estimates have been made for furnishing a steam plant at each pumping station, as being cheaper and more reliable than generating the power at one station and distributing it by electricity. The first cost of

the pumping plant is very small compared with the cost of furnishing the water from the Blackstone River, but the operating expenses are very large. Upon comparing the two estimates on the basis of capitalizing the operating expenses of both systems, the pumping system was found to be the least expensive. Moreover, the pumping system would be more compact, and there would be much less disturbance of local conditions.

One serious objection to the use of the water from the Blackstone River is its polluted condition, it being, according to the reports of the State Board of Health, the most seriously polluted stream in the Commonwealth.

Locks.

The highest point on the line of the canal is about 160 feet above mean sea level, and is located just north of the city of Brockton, in Holbrook and Avon; and the water surface of the summit level of the canal has been fixed at elevation 130. The ascent from Weymouth Fore River to the summit is quite regular, and much steeper than the descent to Taunton River.

The estimate provides for 5 locks, each of 25 feet lift, in addition to the tidal locks, to reach the summit level from Weymouth Fore River. The first 2 of these, located at Weymouth landing, are arranged as tandem locks, and are built double. The other 3 locks are built single, and are located on one side of the centre line, so that a companion lock can be built in the future without disturbing the existing one.

Between the summit level and the tidal lock in the Taunton River the estimates provide for 7 locks, with lifts varying from 21 to 16 feet; they are all single locks, arranged the same as the single locks between the summit level and Weymouth Fore River.

The locks are all planned to be 60 feet wide and 550 feet long between the hollow quoins, this length being divided into two chambers, respectively 350 feet and 200 feet, by a set of middle gates. The total length of the lock structure over all is about 730 feet, and the depth on the sill 25 feet. The gates are planned to be of steel, and of the standard mitre form.

In addition to the operating gates, the estimates include guard gates at both ends of all the single locks, and at the foot and head of the combined locks at Weymouth landing; so that, in case of accident, by closing the guard gates the lock may be pumped out and repairs made without interfering with the other portions of the canal.

The estimates for the locks, as well as for the other structures

in the canal, are principally based on the designs and estimates made by the United States Board of Engineers on deep water ways, and on those of the State engineer and surveyor of New York for a 1,000 ton barge canal from Lake Erie to tide water.

Lock Approaches.

The estimates provide for the construction at both ends of each lock of vertical walls either of concrete or timber cribs, to guide vessels into the lock and allow for their being tied up awaiting the opening of the gates. These are planned so that, in case an additional lock is built later alongside of the existing one, as small a portion as possible of the existing structures will have to be torn out and rebuilt.

By-passes. — Waste Weirs.

The estimates also include the cost of the necessary structures to maintain the level of the water in the canal by discharging any surplus over spillways or waste weirs either into adjacent streams or artificial channels, which will take the water around the various locks into the level below, or waste it into existing streams. These are designed to care for the largest freshet which is likely to occur on the water-shed. It will probably be necessary to enlarge the standard section of the canal in a few places, to enable it to pass the flood discharges; but the time has not been sufficient to go into this matter fully, but, in any event, it will not be a large additional expense.

Estimates have been made for two masonry dams at the two ends of the canal across the Taunton and Weymouth Fore rivers opposite the tidal locks, to impound and maintain at about high-tide level the water in the rivers and tide-level sections of the canal. These, as in the case of the waste weirs of the canal, have been designed to take care of the flood discharges without unduly raising the water level either in the canal or rivers.

Stream Crossings.

As the canal generally follows the thread of the streams flowing through the valleys in which it is located, it receives the natural drainage from the water-shed; and, as the water supply of the canal is to be supplied by pumping water from the Weymouth Fore River, the drainage into the lower levels will be discharged through the waste weirs into the streams where they diverge from the line of the canal; and the Town River, which crosses the line of the canal at West Bridgewater, is to be conducted through a

culvert under the canal, so that the water supply to the streams below will not be interfered with. The mills and dams on the streams at South Braintree and Raynham, lying, as they do, directly in the line of the canal, are necessarily destroyed.

Diversion of Railroads and Highways.

In planning for the construction of work of this magnitude, it is impossible to avoid interfering with many existing structures. The proposed line of the canal crosses the various lines of the New York, New Haven and Hartford Railroad at eight places, in addition to the existing drawbridges at Somerset and Slade's Ferry, and the freight yard at Brockton. At four of these places the crossing cannot be avoided, and estimates have been made for drawbridges. At the others, estimates have been made for diverting the railroads so as to avoid their crossing the canal.

Forty-six highways now cross the line of the canal. Estimates have been made for 14 drawbridges, and for rearranging the highways and diverting some of them. The plans have been so arranged that the distance to be travelled in most cases will not be materially increased over the distance between the same points by the existing routes.

The railroad bridges are all planned for two tracks, except the one at Campello, which is planned for four. The highway bridges, are planned to carry an electric railway, to have a roadway 34 feet wide, and two sidewalks, the whole to be 50 feet wide over all.

In all cases the clear width for the passage of vessels is to be 100 feet, except in the four-track bridge, and where the bridges are located at the ends of locks; in these cases the clear passage-way is to be 60 feet, the same as the width of the locks.

Owing to the sharp angles at which the railroads cross the canal in some places, and at others to the curves in the railroads, it was found necessary to plan slight deviations in the locations of all the railroads but one, in order that they might cross the bridges on tangents, and more nearly at right angles to the line of the canal. The estimates include the cost of a new railroad bridge across the Taunton River at Somerset, as the draw in the present bridge is not adapted for the convenient passage of large vessels.

Protection of the Walls and Banks of the Canal.

Wherever the water level of the canal will be above the present surface of the adjacent country, the embankments on the sides are planned to have puddle walls of clay built through their centres; and wherever the banks of the canal throughout its length consist

of earth, the estimates provide for protecting them with a coating of broken stone, extending from 5 feet below the water level of the canal to 5 feet above that level, as shown on the standard cross-section, in order that they may not be injured by waves created by passing vessels.

Turning Basins.

In order to enable vessels to enter the canal from either end with cargo for any of the cities or towns on the line of the canal, turning basins or harbors have been provided at Taunton, Brockton and Holbrook, approximately 600 feet square, where vessels may be turned around so that they may return.

In addition to these harbors, wharf walls, to be located at various points along the canal, are included in the estimates.

Electric Power and Lights.

The estimates include the cost of an electric power and lighting plant, to be located and operated with one of the pumping stations and the necessary wire lines, lamps and motors, to operate the drawbridges, lock gates and sluices and to light the canal throughout its length.

Right of Way.

The cost of sufficient right of way to enable the canal to be constructed without trespassing on other property has been included. The area required is based on the amount of territory required to deposit the material excavated from the canal alongside of the place from which it is excavated, without piling it higher than 10 feet above the surface, and not allowing it to come within 25 feet of the bank of the canal at any point. This general plan has been modified in its application, so that through cities and improved territory a comparatively narrow strip should be taken, generally little more than sufficient for the operation of the canal; and where the land was of less value, larger areas are included, in order to allow room for the deposit of material taken from the narrower sections.

Unit Prices.

The unit prices used in determining the value of the work to be done in the construction of the canal are based very largely on those adopted by the United States Board of Engineers on deep water ways, and those used by the State engineer and surveyor of New York in making his estimates for the 1,000 ton barge canal through New York. These have been compared with the prices

paid for work on the metropolitan water system and other works in the vicinity of Boston, and modified as found necessary.

The larger part of the masonry has been estimated as concrete, stone to be used only where the masonry will be subject to wear.

Estimates.

Owing to the short time which was available for making up the estimates, and to the uncertainty as to the exact character of the material through which the canal is to be constructed, it has been impossible to make the estimates with the exactness which would have been done if time and means had allowed; and for this reason it has been deemed best to add 15 per cent. to the figures, to cover possible contingencies and unknown quantities, as well as the usual expenses attending any such undertaking. The estimates are as follows:—

Excavation, including approaches between Quincy Point	
bridge and Slade's Ferry bridge,	\$20,103,662
Backfill,	908,080
Culverts and by-passes,	980,000
Retaining walls,	1,494,660
Puddle walls,	144,317
Wash walls,	1,196,072
Spillway and waste weirs,	815,000
Stop gates,	300,000
Highway changes,	343,100
Railroad changes,	462,000
Highway bridges,	1,633,000
Railroad bridges,	1,380,000
Dams,	170,000
Locks,	12,233,000
Lock approaches,	2,406,620
Power and lighting plant,	220,000
Water supply plant,	2,532,499
Maintenance plant,	200,000
Right of way and damages,	2,580,910
Engineering and contingencies, 15 per cent.,	7,515,438
<hr/>	
Total,	\$57,618,358

The work of preparing the report and estimates has been pushed with all practicable speed, and every effort has been made to have the estimates as complete and accurate as possible with the information available; in order to do this, plans have been used before they were inked in and completed. The office force is still at work

on them, but it will be some time before they are completed, and, with the field notes, put in proper shape to record and file away.

Two plans, one showing the location and the other the profile of the proposed canal line, are forwarded herewith, together with a diagram showing the standard cross-sections on which the estimates are based.

Respectfully,

FRANK W. HODGDON,
Engineer.

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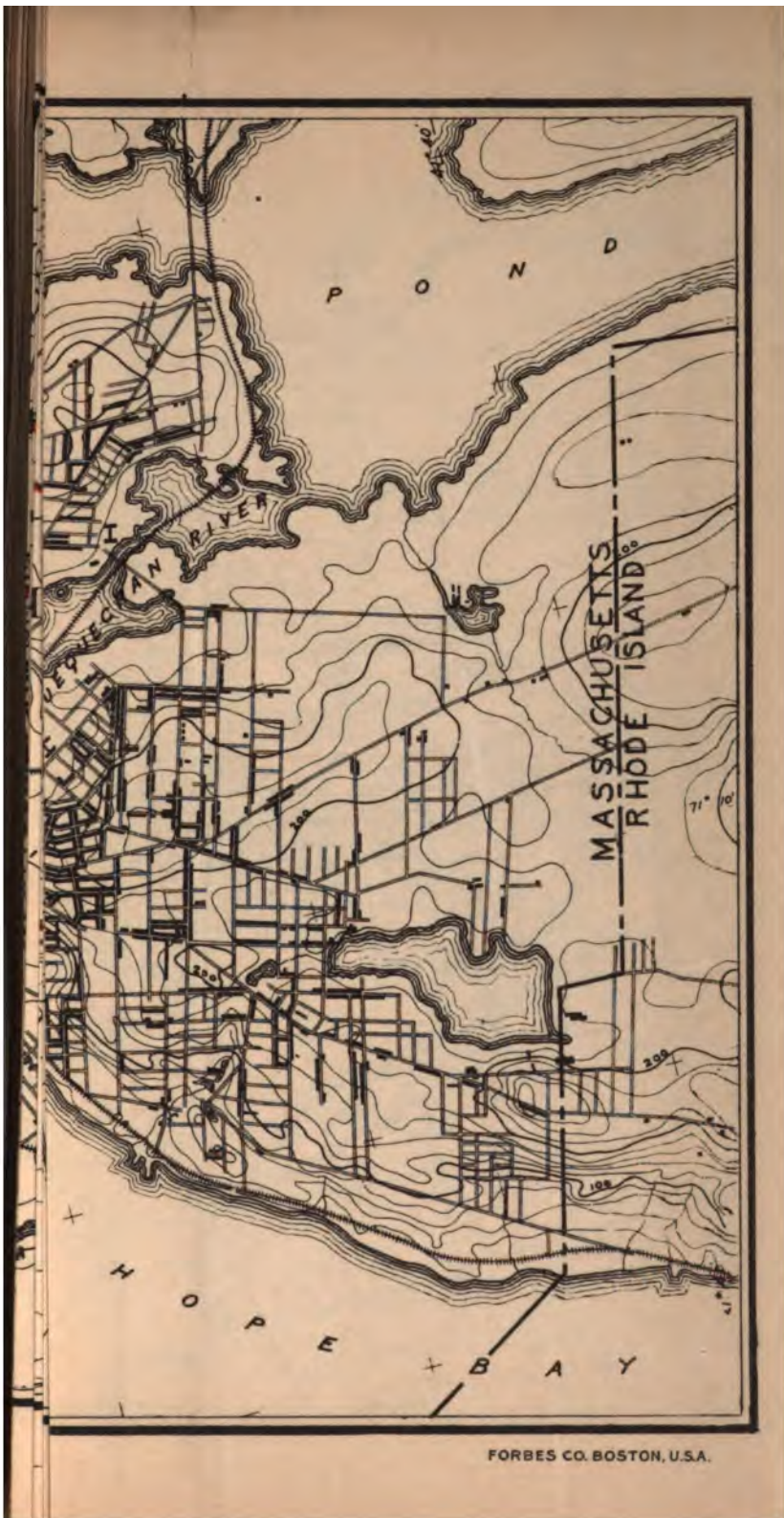
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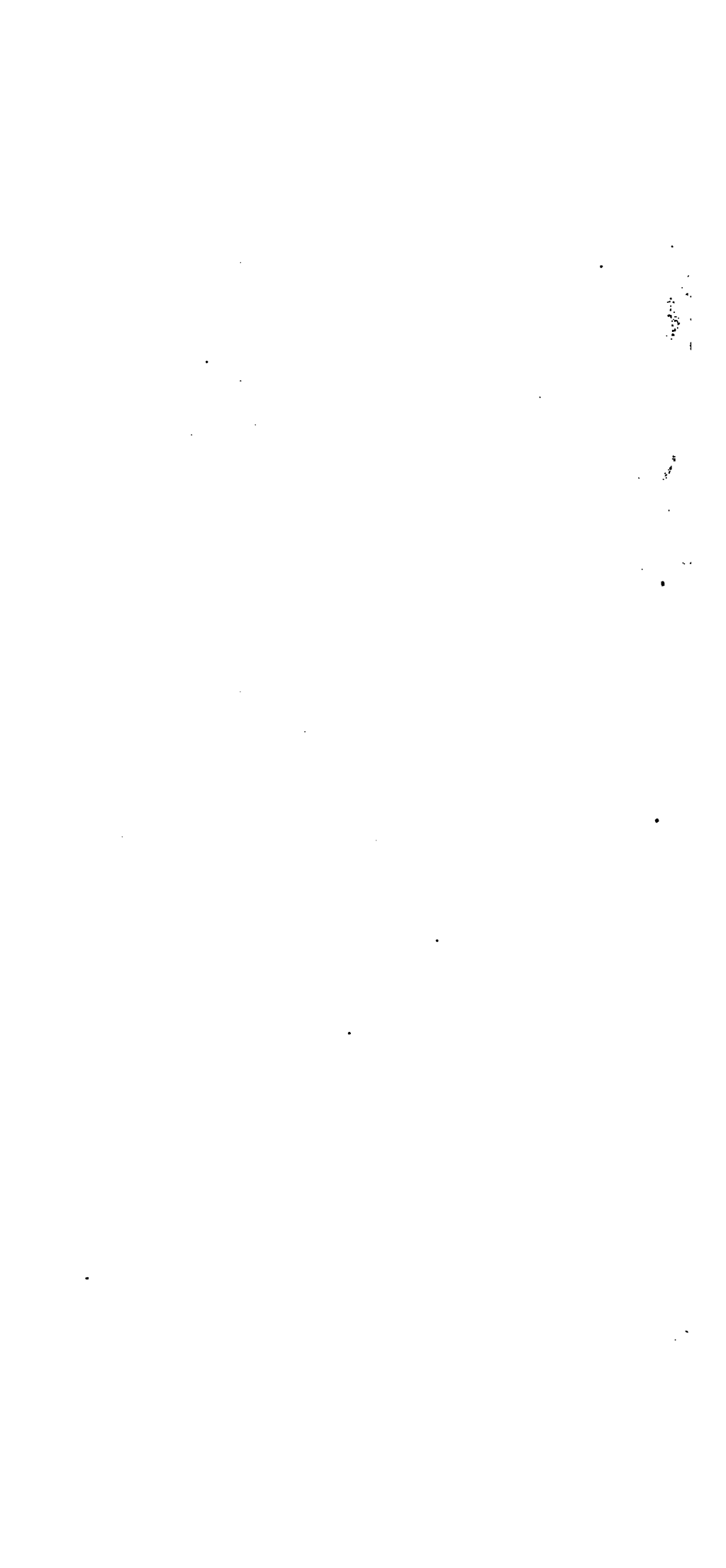


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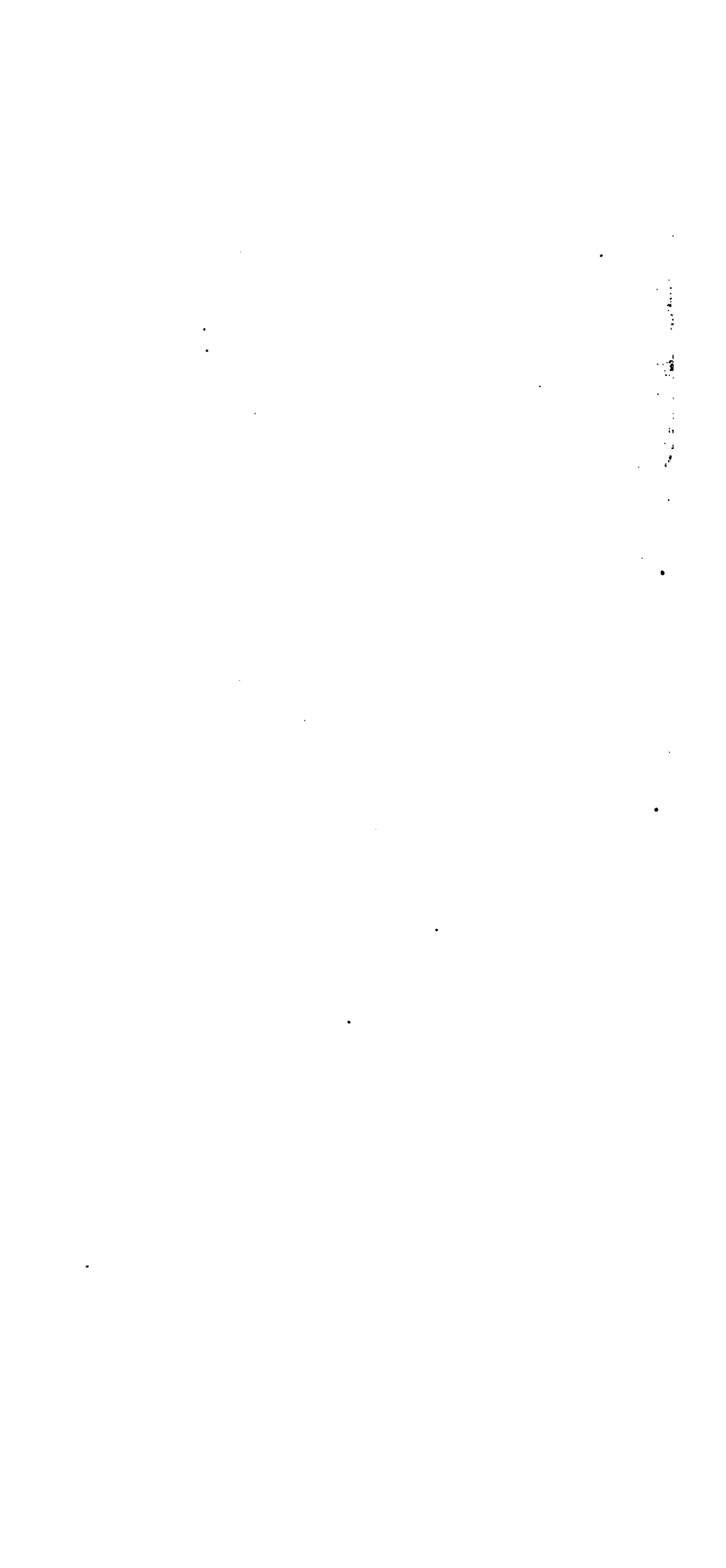
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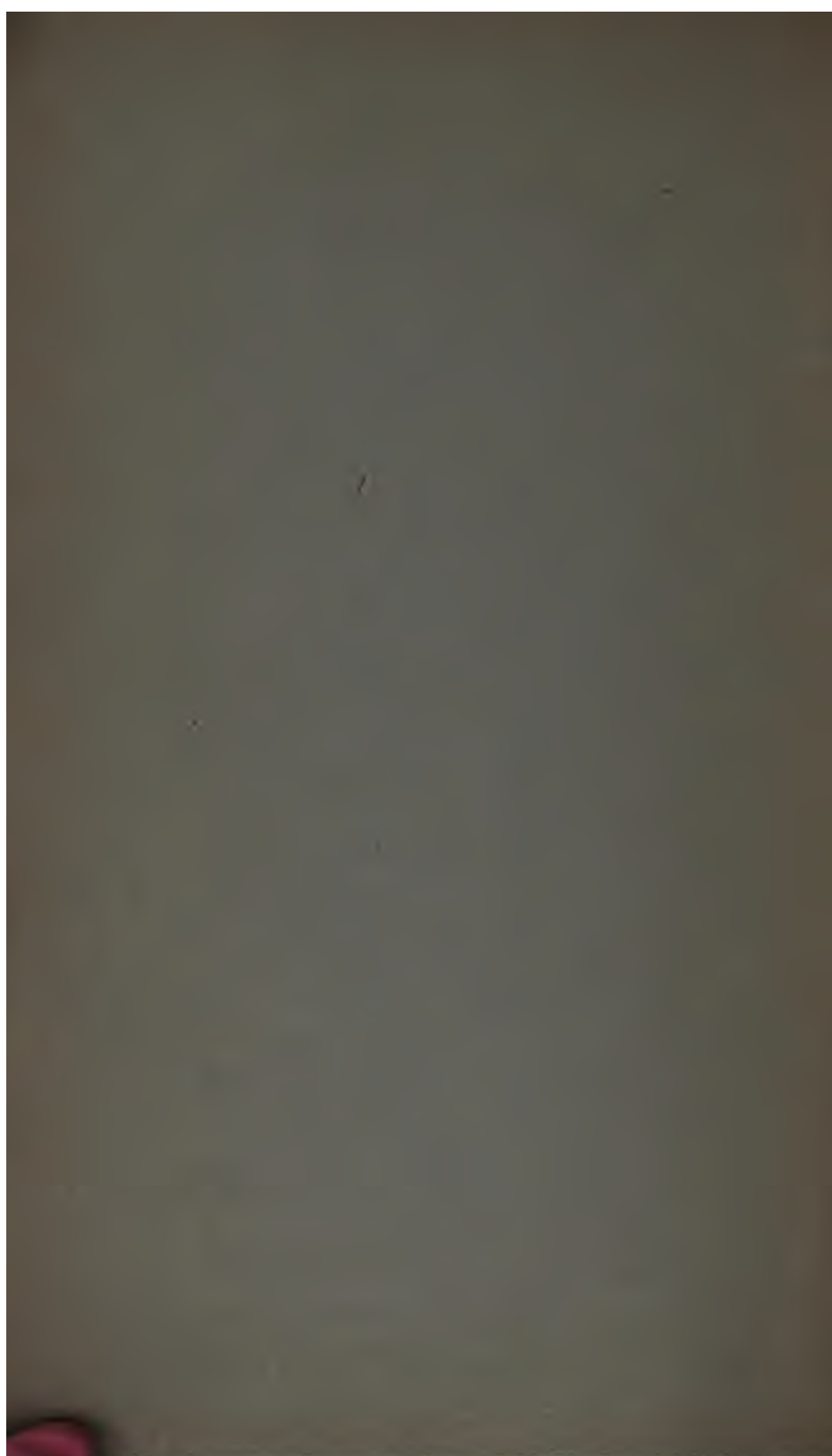
OF THE

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FOR THE YEAR 1902.



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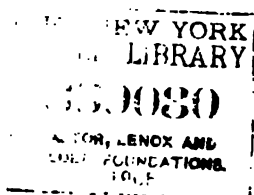
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APPROVED BY
THE STATE BOARD OF PUBLICATION.

Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1902, covering a period of twelve months, from Nov. 30, 1901.

From Dec. 1, 1901, to Nov. 30, 1902, the Board has held 225 meetings, has given 311 formal and informal hearings, and has received 188 petitions for license to build and maintain structures and for privileges in tide waters and great ponds, to dredge material, to remove material from beaches, and for other purposes.

One hundred and twenty-eight licenses for structures and privileges in tide waters and great ponds have been granted during the year; also 18 permits for dredging, for the removal of material from beaches, and for other purposes.

Seventy-one inspections have been made by the Board at various times of work completed and in progress, under appropriations made by the Legislature, in Boston harbor, the Reserved Channel and the Commonwealth flats at South Boston, South Bay, location of dredging off the southerly shore of South Boston, the Province Lands in Provincetown, protective works on Connecticut River at Hadley, Herring River at West Harwich, East and West bays at Osterville, jetties at Bass River, Scorton harbor, jetties at Menamsha Inlet, breakwater at Apponagansett harbor, sea wall at

North Scituate, sea wall and jetties at Stony Beach in Hull, work in progress at Lake Anthony in Cottage City, Cataumet harbor, survey work at Mt. Tom and Mt. Nonotuck, Merrimac River relative to determining the advisability of opening the river to navigation, New Bedford and Fairhaven bridge; also of the sites of proposed work in tide water and great ponds upon petitions and plans presented to the Board, the location of wrecks and obstructions to navigation, and various structures built under licenses from the Board.

Through transactions of the Board there has been paid into the treasury of the Commonwealth during the past year, from rents, licenses, sales of land and other sources, and credited to the Commonwealth's flats improvement fund and the harbor compensation fund for Boston harbor, the aggregate sum of \$1,051,568.38.

During the year 18 new contracts* were made by the Board, duly authorized for the estimated expenditure of \$661,438.80.

COMMONWEALTH TIDE LANDS.

The Governor and Council, under the provisions of section 24 of chapter 96 of the Revised Laws, determined that the compensation for the rights granted in land of the Commonwealth, to be filled or otherwise occupied under the following licenses granted by the Board, should be as stated below:—

No. 2614, granted April 25, to the Fall River Iron Works Company, to build a sea wall and fill solid on Taunton River, in Fall River, \$200.

No. 2642, granted July 17, to William F. Nye, to extend his wharf at Fish Island in New Bedford harbor, \$50.

No. 2663, granted October 10, to the New England Cotton Yarn Company, to build a bulkhead, drive piles, fill solid and erect a building on Acushnet River, in New Bedford, \$100.

No. 2665, granted October 31, to the city of Boston, to repair and build an addition to its wharf on the easterly side of Long Island in Boston harbor, \$30.24.

* See Appendix A.

BOSTON HARBOR.

The citizens of the Commonwealth will never fail to maintain a lively interest in the harbor of Boston. Its natural advantages invited early settlement on its shores, and to-day its improved water ways and accommodations lay claim to a fair share of the commerce of the country with foreign ports.

For years it has ranked as the port of second importance in its tonnage of exports and imports, and during that time has averaged over nine per cent. of the total import and export values of the whole United States. Up to 1895 its customs duties on imports amounted to \$570,086,708, out of a total for the country of \$5,819,231,013.

During the same time the appropriations by Congress for improvement in all the harbors of the Commonwealth have been less than two and one-half per cent. of the total appropriations for the entire country.

Meantime, the Commonwealth, by its Board of Harbor and Land Commissioners, has since 1874 expended the sum of \$1,699,481.14 in improving the navigable conditions in the harbor by dredging at the following places: Junction Shoal, Bird Island Shoal, Fort Point Channel, Reserved Channel, Winthrop Channel, off East Boston, South Bay, Chelsea Creek, Shirley Gut, and Charles, Mystic and Neponset rivers, besides deepening the main ship channel of the upper harbor.

The Legislatures of 1901 and 1902 made a still further appropriation of over \$1,100,000 for improving the anchorage accommodations alone, which is now being expended.

In addition to the expenditures by the Commonwealth, the federal government has spent in the neighborhood of \$3,000,000 for improvements of the harbor, and has matured projects for which a yet larger sum has been appropriated. The United States project of 1892 contemplated widening the channel between the outer light and East Boston south ferry to 1,000 feet, and deepening it to 27 feet at mean low water, at a cost of nearly \$1,500,000. The strictly dredging part of this has been accomplished,

although a considerable quantity of rock is yet to be removed.

The project of 1899 proposed a new outlet channel from President Roads through Broad Sound, to be 30 feet deep at mean low water and 1,200 feet wide. This is nearly completed.

The project of 1902 involves dredging the channel 35 feet deep at mean low water, from the Charles River and Chelsea bridges and the Navy Yard, 1,200 feet wide, to President Roads, and thence through Broad Sound, 1,500 feet wide, to the sea, at an estimated cost of about \$8,000,000, of which \$3,600,000 has been appropriated for expenditure under the continuing contract system. Contracts for this work are about being made.

When these projects are completed, Boston harbor will have three distinct entrance channels, — one 35 feet deep and 1,500 feet wide and another 30 feet deep and 1,200 feet wide, both through Broad Sound, and one 27 feet deep and 1,000 feet wide, known as the main ship channel, through the Narrows. When the mean rise of tide, 9.8 feet, is added to these depths, it will be seen that at high tide there will be water enough to navigate any steamship now afloat at her loaded draught. In fact, the deepest of them could come in or go out at half tide with safety.

It is encouraging to realize that the port of Boston, although still awaiting further improvements, is not less prepared than other great ports, both here and abroad, for the floating of modern steamships. Not only is New York having its harbor channels widened and deepened, and Liverpool having new docks built with lower gate sills, but London has been awakened by loss of trade to the necessity of overhauling its dock system and deepening the channels of the Thames.

At London, with its population of 6,000,000 in 1899, goods were imported of the valuation in round numbers of £164,000,000, or about \$820,000,000. Nevertheless, the falling off in the *entrepot* trade led to the appointment of a Parliamentary Commission on the Port of London, which reported in favor of dredging a channel 36 miles long from the

Nore to the Royal Albert Dock, to be 30 feet deep at low tide, and 1,000 feet wide for a distance of 29 miles and 600 feet for the balance; thence about 9 miles to the London docks, 25 feet deep, at a cost, including the completion of certain river accommodation work, of £2,500,000, or about \$12,500,000. Then the docks must be purchased and put into condition and fitted for modern needs, at a cost of £24,500,000, or about \$122,500,000, making a total, to fit the port of London to do a successful and competing business at the present day, of £27,000,000, or about \$135,000,000.

Liverpool, in addition to \$200,000,000 already expended on its system of docks, is spending yet more in dredging and increasing its dockage accommodation for twentieth-century ships.

Bristol, Eng., is another port aroused to the requirements of the day and, with a population of only 318,000, recently procured an act of Parliament to permit the expenditure of the large sum of \$13,875,000 for the improvement of the port at Avonmouth, in order to provide twentieth-century accommodations to steamships. These projects are perfected and the work well advanced. Already these increased facilities are attracting attention, and a new line between Bristol and Boston is under negotiation.

As compared with the sums spent on harbors abroad, such as \$200,000,000 at Liverpool, \$74,000,000 at Glasgow, \$39,000,000 at Hamburg, \$28,000,000 at Havre, \$26,500,000 at the Tyne ports, \$26,000,000 at Rotterdam, \$25,000,000 at Antwerp, \$23,000,000 at Marseilles, \$13,800,000 at Melbourne and \$11,400,000 at Bombay, the amounts so far expended for the improvement of the port of Boston do not seem large.

When all the present projects shall be completed, the harbor of Boston, in point of approach, entrance, protection, depth, area, anchorage, convenience and port charges, will compare favorably with any of those above named.

ANCHORAGE.

By chapter 476 of the Acts of 1901, the Board was authorized to provide additional anchorage ground in Boston harbor, northerly of the main ship channel, in substantial accordance with the project prepared by the Board and described in its report to the Legislature for the year 1900. Section 3 of the act required the Board to obtain from the owners of Bird Island Shoal a release of all their right, title and interest therein, without expense to the Commonwealth.

A release dated Nov. 11, 1901, was received from the only known owner, the city of Boston. For the purpose, however, of confirming the title in the Commonwealth, a petition was filed by the Attorney-General with the Court of Land Registration, and on April 24, 1902, a decree of confirmation of the title was entered.

The Board at once proceeded to prepare the necessary plans and specifications, and, with a view to carrying on the work economically and expeditiously, divided the total area lying along the northerly side of the main ship channel, and covering about 1 mile in length and 1,000 feet in width, into four sections, each to be excavated to a depth of 30 feet at mean low water.

Proposals for dredging these four sections were received June 26, 1902, and on the same date a contract for Section 1 was entered into with the New England Dredging Company and the Eastern Dredging Company, jointly, the lowest bidder. The estimated amount of dredging in this section is about 646,500 cubic yards, measured in situ, the area to be dredged containing about 1,505,000 square feet, and the contract price for each cubic yard dredged and deposited at sea being $16\frac{3}{10}$ cents. Further terms of this contract were modified by agreement dated Oct. 27, 1902, approved by the Governor and Council October 29, and provide for the deposit of acceptable material dredged from other parts of the harbor in substitution for that taken from the anchorage ground, to an amount not exceeding 300,000 cubic yards, on the easterly portion of the Commonwealth flats at South Boston, within an area of about 25 acres, partially enclosed by a bulkhead

and sea wall, now being filled for improvement. For re-handling and grading the material required to fill this area on the Commonwealth flats, which in the opinion of the engineer of the Board cannot be deposited directly from hopper-bottom scows, the price of $18\frac{5}{10}$ cents per cubic yard, measured in the fill, is to be paid.

Contracts for the remaining three sections were entered into with Geo. H. Breymann & Bros., the lowest bidder, on June 26, 1902, details of the contracts being as follows:—

Section 2, estimated amount of dredging, about 651,600 cubic yards; area to be dredged, about 1,200,000 square feet; contract price, 15 cents for each cubic yard dredged and deposited at sea, measured in scows.

Section 3, estimated amount of dredging, about 646,700 cubic yards; area to be dredged, about 1,150,000 square feet; contract price, $15\frac{1}{2}$ cents for each cubic yard dredged and deposited at sea, measured in scows.

Section 4, estimated amount of dredging, about 654,300 cubic yards; area to be dredged, about 1,630,000 square feet; contract price, 16 cents for each cubic yard dredged and deposited at sea, measured in scows.

The differences in the contract prices are to be accounted for in the variation of physical conditions under each contract and the distributive requirements of the contract relating to Section 1.

All of the work in the four sections is to be completed not later than July 1, 1904.

The amount of material excavated from each section, up to Dec. 1, 1902, is as follows:—

	Cu. Yds.
Section 1,	170,654
Section 2,	111,515
Section 3,	15,326
Section 4,	13,805
Total,	311,300

The construction of the pile piers for mooring vessels and the solid filling on Bird Island Shoal will not be commenced until the dredging of the area nearest the ship channel has been nearly completed.

DREDGING IN BOSTON UPPER HARBOR.

Pending the completion of the projects of the federal government, the Board became satisfied of the necessity of enlarging some of the channels in the upper harbor, in order to enable the deep draught steamships of the present day to conveniently reach their docks.

In 1900 a channel was dredged by the Commonwealth through the bar at the confluence of Charles and Mystic rivers, 250 feet wide and 25 feet deep at mean low water. Since that time another and larger dock has been built between the Hoosac Tunnel piers and the Navy Yard, and the size and draught of the steamers docking there has increased.

Naturally, the channel proved inadequate. Accordingly, on April 14, 1902, a contract, for the purpose of enlarging the existing channel, was entered into with the New England Dredging Company, the lowest bidder, to dredge an area at the mouth of Charles River, extending from a point opposite the south-westerly corner of Pier No. 6 of the Hoosac Tunnel docks down past Fiske's wharf to a point opposite the north corner of Battery wharf, to a depth of not less than 27 feet at mean low water; the object being to continue the 27 foot channel dredged by the federal government from the point at which its work under the project of 1892 ceased, up to the docks. This contract, calling for an expenditure of about \$29,000, is to be paid for out of the income of the harbor compensation fund, at the rate of 29½ cents for each cubic yard of material, measured in scows. The work was at once commenced, but proceeded more slowly than was anticipated, owing to accidents and the heavy character of the material dredged. Up to Dec. 1, 1902, 94,445 cubic yards have been excavated, leaving a small ridge to be removed before the undertaking will be completed.

In October, 1901, petitions were received from the owners of Union and Lincoln wharves, asking that a portion of the harbor be excavated to a depth sufficient to enable steamers to enter the new berths then being dredged at their wharves. After an examination of the premises it was decided to

dredge to the depth of 23 feet at mean low water the whole distance from Lewis wharf to the North Ferry, and in breadth from the ship channel to a line 50 feet outside of the harbor line, thus lowering the bottom of the fairway to a uniform depth, throughout this section, of not less than 23 feet, and giving ample depth for coastwise vessels. The neighboring areas had previously been dredged.

A contract for this work was entered into with the New England Dredging Company, the lowest bidder, under date of Nov. 22, 1901, at the rate of $32\frac{7}{8}$ cents per cubic yard, measured in scows, and was completed Jan. 6, 1902, 15,093 cubic yards having been excavated at a cost of \$4,217.53.

DRY DOCK.

The inadequacy of the present dry dock accommodation at this port is a matter of common knowledge. The usefulness of the new dry dock at the Charlestown Navy Yard for merchant vessels will be wholly contingent upon whether or not it may be occupied or needed for war vessels, the growing number of which renders the chance for merchant vessels a constantly decreasing quantity.

It may be safely said that no leading port abroad is so deficient in this respect as Boston, as, for instance, at Liverpool there are 24 dry or graving docks, at Antwerp 10, at Southampton 5 or more, one of which is 750 feet long; the largest, 925½ feet long, is at Liverpool. It would be unfortunate if, after the other requirements of a first-class port had been complied with, opportunity for docking in case of needed repairs should be found lacking. Economical reasons for making repairs on the other side of the Atlantic are diminishing, and when the time comes that repairs can be made as cheaply and advantageously at this port as elsewhere, a new and valuable industry offers itself for encouragement.

LIGHTS AT BROAD SOUND CHANNEL AND STATE LEDGE.

On January 29 the following letter from the Board was sent to the committee on interstate and foreign commerce of the House of Representatives at Washington, in regard to

the establishment of a lighthouse and fog signal station on State Ledge in Boston harbor: —

JAN. 29, 1902.

To the Honorable Committee on Interstate and Foreign Commerce, of the House of Representatives, Washington, D. C.

GENTLEMEN: — The Board of Harbor and Land Commissioners of the Commonwealth of Massachusetts desires to impress upon your honorable committee the great urgency for a lighthouse and fog signal station on State Ledge in Boston harbor.

State Ledge is located midway down the harbor, a short distance from Castle Island, just before entering President Roads. Its position is such as to require a change in the course or direction of vessels navigating the lower middle channel.

In March, 1895, the "Venetian," an iron freight steamer plying between Boston and Liverpool, was wrecked on this ledge on her way out. The federal government declined to remove her, on the ground that she was on the edge of the channel and not in the channel, claiming that the pilots of the port preferred her to remain, because she answered the purpose of a lighthouse. Navigators could see her looming in the night or the fog, when they could not find the buoy which marked the ledge on which she rested. Other wrecks have also marked the spot for a time, as a peril to navigation.

I believe there never has been a dissent on the part of any of the United States officers stationed at this port from the proposition that the channel should be marked by a lighthouse on State Ledge.

The greater the commerce of the port, — which has been doubled in a quarter of a century, and last year amounted to \$197,005,118, — the greater is the need for this proposed lighthouse.

An inspection of the locality alone would lead to a conviction of the necessity for this light, and render argument in opposition to it futile.

For the Board,

WOODWARD EMERY,
Chairman.

Delegations of merchants also visited Washington and urged the necessity for this lighthouse. The estimate of appropriations sent to Congress at its present sitting by the Secretary of the Treasury includes the sum of \$52,000 for light and fog signal stations at State Ledge.

On March 6 the Board, having been apprised that a bill

providing for marking the entrance to Broad Sound Channel, Boston harbor, had, through the efforts of Senator Lodge, at the request of this Board, passed the Senate, sent the following letter to each of the Representatives in Congress from Massachusetts : —

MARCH 6, 1902.

DEAR SIR : — A lighthouse bill has just passed the Senate, providing for marking the entrance to Broad Sound Channel in Boston harbor with a lighthouse on the Graves and other range lights. As Broad Sound Channel will be completed this summer, it is very desirable that this appropriation should go through as early as possible, in order that the channel may be made available for navigation.

We ask your earnest effort in this behalf.

Yours respectfully,

WOODWARD EMERY,
Chairman.

This bill became a law.

On July 8 a communication was received from Lieutenant-Colonel Stanton, engineer of the second lighthouse district, requesting the Board to convey to the United States the title of the Commonwealth to a tract of land covered by navigable waters of Massachusetts Bay at the north-east Grave at the entrance to Boston harbor, for the purpose of erecting a light and fog signal station. A deed was immediately executed by the Board under the provisions of section 8 of chapter 1 of the Revised Laws, and approved by the Governor and Council.

WINTHROP CHANNEL.

On May 22 a petition was received from the Boston Chamber of Commerce and others, calling attention to the necessity of immediate relief by dredging Winthrop Channel to its original required depth of 8 feet at mean low water. The Board also gave a hearing to the Winthrop Yacht Club and others on this subject. As no funds were available for this work, the relief asked for could not be given.

Early in July notice was received from the officers of the Winthrop Steamboat Company that there were certain rocks in the portion of the dredged channel leading to the wharves

at Winthrop, nearly opposite Snake Island, which the propellers of its steamers had struck. The Board caused examinations of the channel to be made at three different times, when officers of the steamers were present, but was unable to find any trace of rocks in the localities pointed out by the officers, or elsewhere.

SHIRLEY GUT.

A survey of Shirley Gut was made early in May, when it was found that during the winter considerable quantities of gravel had been driven along the beach and deposited at the point within the area which had been dredged the previous year, thereby narrowing the channel. The northerly portion of the area which had been dredged has apparently not been affected. In granting permits for taking gravel from this locality, the material being used in building operations, an arrangement was made with the Eastern Dredging Company to remove without expense to the Commonwealth the material which had drifted into the channel during the winter from the area northerly of the metropolitan sewer, and with the Bay State Dredging Company from the area southerly of the metropolitan sewer, thus restoring the channel to the same condition as in 1901. This was done before the boats of the Clyde line began their trips to Nahant. It will probably be necessary to do some dredging in this locality each year, to remove material which is driven in by the sea during the winter. In dredging for gravel at this place a large part of the bar or spit which made out from the north-westerly point of Deer Island has been removed, and if the demand for gravel continues another year, a channel will undoubtedly be excavated through this bar, thus making the passage through the Gut less crooked and more easily navigated.

DORCHESTER BAY.

By chapter 425 of the Acts of 1902, the Board was directed to dredge an area in Dorchester Bay, off the southerly shore of South Boston, to a depth of not more than 12 feet at mean low water, at an expense not exceeding \$100,000, to be ac-

complished during the four years, 1902 to 1905, — the object being to provide an area within which yachts anchoring in this locality could lie afloat at all stages of the tide, and also to give approaches to the yacht landings along the city parkway.

As dredging done in various places had destroyed the value of the survey of this area, a re-survey became necessary, and was made during June and July. Subsequently, representatives of the various yachting associations and others interested were invited to a conference with the Board. As an outcome of the opinions expressed, it was finally determined that the best results could be obtained by dredging two basins, the larger one with an area of about 56 acres extending easterly a distance of about half a mile from the line of O Street, the smaller one with an area of about 9½ acres and located opposite the block between K and L streets. The larger basin will have a depth of 9 feet at mean low water to accommodate the large yachts frequenting the public landing and the yacht clubs in its vicinity; the smaller basin will have a depth of 6 feet at mean low water to accommodate the small yachts and those making a landing at the Mosquito Fleet Yacht Club.

Proposals for this work were received on October 9, but the Board, deeming the prices too high, rejected all the proposals, and on October 29 entered into a contract with the New England Dredging Company and the Eastern Dredging Company, jointly, at a lower rate of 21 cents per cubic yard.

Work was commenced November 5, and up to Dec. 1, 1902, 11,212 cubic yards of material have been excavated, a portion of the same being taken to sea and a portion used in filling the Commonwealth flats on the northerly side of South Boston.

HULL.

By chapter 483 of the Acts of 1901, an appropriation of \$10,000 was made for the building of sea walls or other structures along Stony Beach, in Hull. This act was approved June 10, 1901, but did not take effect until accepted by the town of Hull by a vote on Sept. 12, 1901, too late

in the season to begin the work. Surveys were made and plans and specifications prepared, and, as the wall and jetties were to be built on private land, a taking was made on March 7, 1902, of the right and easement to enter upon this land, and build, maintain and repair the wall and jetties.

On March 25, 1902, a contract was entered into with Lawler Bros., the lowest bidder, to build 1,431 feet of concrete sea wall, for the sum of \$4.90 per lineal foot of wall 8 feet high, and \$3.50 per lineal foot of wall 6 feet high, and 720 feet of spur jetties of the same material, for the sum of \$2.50 per lineal foot, on the outer slope of Stony Beach between Point Allerton and the point where the New York, New Haven & Hartford Railroad crosses the highway just east of Stony Beach station. This work was completed July 30, 1902, at an expense, including supervision and contingencies, of \$8,352.85, or \$3.88 + per lineal foot.

THE COMMONWEALTH FLATS AT SOUTH BOSTON.

In May, 1898, during the progress of the extension and elevation of Summer Street over the freight yards of the New England Railroad Company and across the property of the Commonwealth, the Board opened negotiations with the New York, New Haven & Hartford Railroad Company, with a view to selling it land east of B Street, for the purpose of increasing the area of its freight yard at South Boston. These negotiations continued in a somewhat intermittent way until last spring, when an arrangement was finally consummated for the conveyance of land lying between B Street on the west, C Street on the east, Fargo Street on the north and Anchor Street on the south, for the sum of \$1,000,000.

There are two ways of valuing this sale: one from the Commonwealth point of view, which is taking the area of the six lots sold outside of the streets, as indicated on "Plan of South Boston Flats, December, 1896," amounting to 685,629 square feet, and dividing the purchase money by the area. This yields \$1.46 per square foot for the land sold within the lot areas, besides saving the cost of preparing the cross streets for travel and use by prospective purchasers in case the lots were cut up and sold in parcels bounding

thereon. The other would be the point of view of the purchaser, and that is, to divide the price paid by the total number of feet of land acquired, which would include not only the area of the six lots aforesaid, but also the areas of the streets. By this method of computation the price per foot would be somewhat reduced. Doubtless these different points of view enabled the parties to come together.

Before consummating the foregoing transaction, it became necessary to have legislative action for the purpose of discontinuing B Street, — a public way heretofore laid out and lying between the yard of the New England Railroad Company and the property sold, — and laying out C Street parallel thereto; and provision therefor was made by chapter 377 of the Acts of 1902.

The sale of this land is of advantage to the Commonwealth in replenishing the fund from which the cost of the improved anchorage basin in Boston harbor is to be defrayed, and will be of value to the public by increasing the freight-distributing accommodations of the railroad company lying within $1\frac{1}{4}$ miles of State Street.

On March 4, 1902, the Board executed a deed from the Commonwealth to Philip H. Butler of 10,500 square feet of land on the Commonwealth flats, bounded by Anchor and B streets, the consideration being \$6,300. This deed was given in accordance with the provisions of a bond from the Commonwealth to the said Butler, dated March 7, 1899.

On May 7, the Board executed a deed from the Commonwealth to James Richard Carter, William B. Rice and Andrew G. Webster, trustees, of two parcels of land on the Commonwealth flats, containing 159,463 square feet, bounded north-easterly by the south-westerly side line of Summer Street, the consideration being \$260,728.50. This deed was given in accordance with the provisions of two bonds from the Commonwealth to the said Carter and others, dated Jan. 10, 1899, and June 12, 1900, respectively.

On May 20, the Board executed a lease from the Commonwealth to the Boston Molasses Company of a parcel of land on the Commonwealth flats north-easterly of Summer Street, containing about 249,287 square feet; also a pile

pier in front of the leased premises, to be built by the Commonwealth. The lease is for fifteen years from July 1, 1903, the yearly rental being \$9,500.

Heretofore it has not been the policy of the Commonwealth to pay a brokerage commission for the sale of her lands; but during the past year, acting under the advice of the Governor and Council, the Board acceded to the request of the Boston Real Estate Exchange, which had last year petitioned the Governor in favor of the policy of allowing such commissions, and the Commonwealth now pays the usual commissions to real estate brokers.

In May the engineering force ran out the lines of the streets south of Summer Street, and set stone bounds at the corners. The work of filling with material brought to the flats from cellar excavations and similar sources in the city by various contractors has been continued, over 40,000 loads having been delivered during the past year. This material has been used in surfacing the flats on the northerly side of Summer Street, which had been filled with material dredged from the harbor. In portions of this area the harbor filling had settled, and the material brought from the city was used in bringing these low spots up to the general level, and, in addition, the balance of the filling was covered with a coating, raising it generally to a grade of about 14 feet above mean low water. This was accomplished early in the fall, and since then the material has been used in filling in the lands between the streets south of Summer Street and east of C Street.

The building of the sea wall of granite blocks on a foundation of concrete and piles, all properly ballasted, on the northerly side of the Reserved Channel, under contract with William J. Lawler, dated March 7, 1901, was completed in May, 1902, 1,335.3 lineal feet of wall 18 feet high having been built at a cost of \$75,431.09, or \$56.49 a running foot.

The work of filling the area lying east of the land leased to the Metropolitan Coal Company and enclosed by the sea wall and bulkhead completed last year was begun about Sept. 1, 1902, and has been carried on up to the present time with a view to completing that portion of the area which has

been leased to the Boston Molasses Company. In all 60,578 cubic yards of filling have been put in place up to Dec. 1, 1902.

In order to prepare for occupancy the lot leased as above, a contract was entered into on July 3, 1902, with the J. S. Packard Dredging Company, the lowest bidder, to dredge a berth 18 feet deep on the westerly side and 12 feet deep on the easterly side of the proposed wharf, with an approach 18 feet deep at mean low water from the channel which leads in from the main ship channel of the harbor. This work is finished, 75,522 cubic yards of material having been excavated and deposited at sea at a cost of \$10,845.04, the contract price being 14 $\frac{7}{8}$ cents a cubic yard.

On July 10, 1902, a contract was entered into with George Hayes & Co., the lowest bidder, to build a wharf of oak piles and hard pine timber, 300 feet long and 50 feet wide, to be used by the Boston Molasses Company. This work has been done at a cost of \$11,500.

On Sept. 4, 1902, a contract was entered into with Jones & Meehan, the lowest bidder, to build drains and catch-basins and pave the street necessary to give proper access to the lot leased as above. The drains and catch-basins have been built, and the paving of the approach is well under way and will shortly be completed. In order to raise the approach to the necessary grade for the pavement, an agreement was made with the New England Dredging Company to furnish and deposit on the premises about 2,000 cubic yards of coarse gravel taken from Shirley Gut.

COMMONWEALTH PIER.

Under chapter 513 of the Acts of 1897, the Legislature authorized the construction of a pier and dock on the Commonwealth flats at South Boston, at an expenditure not exceeding \$400,000. This pier, 1,200 feet long and 400 feet wide, creating a surface of wharf area of about 11 acres, has been built, saving a portion of the solid area yet remaining to be gravel surfaced.

The dredging of the dock on the westerly side of the pier, under a contract entered into on Sept. 6, 1901, with the

Eastern Dredging Company, was completed in February, 1902, and there is now in that dock a depth of 30 feet at mean low water for its whole length and width out to the boundary line between the premises of the Commonwealth and of the New England Railroad Company, the width at the outer end being 175 feet and at the inner end 200 feet. The berth at the outer end of the pier is about 30 feet wide, and has a depth of 30 feet at mean low water. Between this berth and the ship channel there is a depth of only 23 feet. On the easterly side of the pier there is a varying depth of from 15 to 4 feet at mean low water.

In October and November the Board permitted vessels loaded with coal and sugar to make use of the dock on the westerly side of the Commonwealth pier and the berth at the end of the pier, for the purpose of discharging their cargoes into lighters alongside, the charge being fixed at 10 cents per ton. From this source there has been collected, up to December 1, and paid into the treasury of the Commonwealth to be credited to the Commonwealth's flats improvement fund, the sum of \$3,875.96.

NORTHERN AVENUE AND BRIDGE.

After many years of persistent labor and the overcoming of serious obstacles, the Board succeeded in uniting the city of Boston and the New York, New Haven & Hartford Railroad Company in a plan for carrying out their agreement with the Commonwealth, made in 1873, for building Northern Avenue, to connect the Commonwealth's flats at South Boston with the city proper. The city and the railroads had reaped the benefits accruing to them respectively under that agreement, and recognized the justice of giving to the Commonwealth the benefits thereunder accorded to her. It is of moment to the Commonwealth, having invested large amounts of money in improvements designed to facilitate the trade and commerce of the port, to have the agreement of 1873 performed, and to be placed in a position to derive an income from her past expenditures, as well as to be able to continue the projects for extended accommodation.

With a full appreciation of the great public advantages in

view, chapter 507 of the Acts of 1901 was passed, and Northern Avenue was laid out and its construction provided for in accordance with the agreement of 1873, dependent only upon the acceptance of the act by the city council of Boston. In October, 1901, the Board wrote the mayor, inviting action by the city council, but none was taken. Again in 1902 the subject was brought to the attention of the mayor, and he gave a hearing at the city hall on February 18, at which public-spirited representatives of the mercantile and commercial organizations and others prominent in business affairs forcibly presented the necessity for immediate co-operation on the part of the city; but local and private interests antagonized the acceptance of the act.

A good deal is being said and written about the Commonwealth joining in the projects of the federal government for deepening and widening the harbor channels, and sharing the expense; and sometimes it is said the Boston municipality should be added, thus creating a triplicate power, for the purpose of a speedier accomplishment of the objects in view. It is extremely doubtful if the somewhat prodigal proposal to share the expense of the project with the United States would do more than add to the citizens' tax bills; it is highly improbable that any such generous offer could be made to hasten the completion of the projects. The federal government is performing its function in providing adequate channels for the needs of growing commerce. The Commonwealth is doing its duty in improving the anchorage basins for craft of any size which seek the waters of the harbor and the bays.

The Commonwealth has, moreover, begun the construction of a series of large piers and docks upon its extended water front at South Boston, in order to provide accommodations for commerce and facilities for business in advance of its growth, and to be in readiness to offer opportunities, and to prevent loss of trade by reason of unpreparedness. The first of the great piers is built, and awaits the avenue of approach to the heart of the city. While in this condition it was of some use in November, when, as a sequence of the coal strike, a large number of colliers, all from foreign

ports, sought berths for lightering their cargoes of coal. Even then the pier could not be utilized for storage and distribution because of lack of a proper avenue of approach.

Amid this expenditure of millions by the federal government and the Commonwealth for the benefit of the port of Boston, the municipality is asked to do but one thing, and that is, to perform its part of the agreement of 1873 as the other parties have performed theirs.

Had the Board in its earlier efforts in 1898 been able to achieve that unanimity of action which resulted in the passage of chapter 507, Northern Avenue bridge might now have been built, and the widening of the draw of Congress Street bridge, at present demanded by the requirements of commerce, accomplished with but comparatively little inconvenience and without the unnecessary cost to the city of a temporary bridge.

The Board recommends such further legislation as may be necessary to accomplish the desired object.

THE COMMONWEALTH FLATS AT EAST BOSTON.

A hearing relative to the claim of the East Boston Company for damages sustained by the taking of its flats by the Commonwealth on Oct. 28, 1898, under the provisions of chapter 486 of the Acts of 1897, began in November, 1902, before an auditor appointed by the Superior Court for the county of Suffolk, and the matter is still pending.

A proper adjustment of trunk line terminals at East Boston is of material interest to the public at the present time, because, whatever conclusions may be reached, they are likely to be final. The growth and development of the shore front and interior of the district will be inevitably along the lines determined by the grade crossing commission, sitting under the provisions of chapter 462 of the Acts of 1900, which ought to be clothed with power not only to eliminate the grade crossings, but to so rearrange the location of all the railroad tracks as to permit of the most available use of the territory for the purposes for which it is best adapted, with a view to economical handling of goods,

wares and merchandise, and dealing with all transportation problems.

When East Boston is encircled with a marginal freight railroad having a spur to every wharf and an elevated passenger service from the end of the tunnel, she will begin the achievement of her destiny; and the plans on broad lines should be matured while the opportunity is open. Let the building up and the details keep pace only with the demand for use and enjoyment.

FORT POINT CHANNEL.

On November 6, notice was received from Lieut.-Col. W. S. Stanton of a hearing to be held on Nov. 17, 1902, relative to requiring the draw opening in Congress Street bridge and that in Mt. Washington Avenue bridge across Fort Point Channel to be widened to a least width of 50 feet.

The widening of these draw openings will be a distinct benefit to navigation, and permit vessels of greater beam to dock at points above these bridges.

SOUTH BAY.

Early in February, 1902, a petition was received from the owners and tenants of the wharves along the southerly and westerly shores of South Bay, asking that the channel in front of their wharves be made wider and deeper. After due consideration plans were prepared for a channel 110 feet wide and 12 feet deep at mean low water, extending from Dover Street bridge along the westerly and southerly sides of the bay, with an enlarged basin in the angle at the mouth of Roxbury canal. Proposals for this work were received May 22, 1902, but were rejected, as being too high. In July a contract was entered into with John C. Cobb to do the work for 23 cents a cubic yard, measured in scows, that being less than the lowest bid, the excavated material to be deposited within the area which the Roxbury Central Wharf and the South Bay Wharf and Terminal Company were authorized to fill under licenses from the Board. The amount of material dredged up to December 1 is 132,782 cubic yards.

This work is paid for from the "Improvement of South Bay in the city of Boston fund," created by chapter 278 of the Acts of 1898, and composed of all moneys paid into the treasury of the Commonwealth for the displacement of tide water in South Bay.

In the summer of 1902 a long-protracted controversy was settled, whereby the Roxbury Central Wharf and the South Bay Wharf and Terminal Company paid into the South Bay improvement fund the sum of \$17,500 net. The Roxbury Central Wharf had petitioned the court to have damages awarded under the decision of *Bent v. Emery*, 173 Mass. 495, for taking its property in South Bay for the purpose of making a channel. It had also, in conjunction with the South Bay Wharf and Terminal Company, filed petitions for licenses to fill in tide water over flats within the harbor line of South Bay. The corporations resisted the claim made by the Board for tide water displaced, contending that the Commonwealth could not rightfully charge for tide water displaced by filling upon flats below mean high water, the surface of which had been artificially lowered, although thereafter for more than twenty years the tides had flowed and ebbed thereover; they also disputed the location of certain channels in the flats claimed to be Commonwealth's land, and denied the existence of the same as natural channels.

These vexed questions have been before the Board for several years, and their elimination at the present time will favor the progress of important and valuable improvements hitherto hampered. The result is not only a substantial addition to the South Bay improvement fund, but an agreement has been made and is on the files of the Board, whereby the Commonwealth, free of claim for damages, may remove by dredging any material from the estates of either or both the Roxbury Central Wharf and the South Bay Wharf and Terminal Company lying outside the harbor line in South Bay at any time hereafter.

As stated in the report of the Board for 1901, a claim of the Commonwealth against the Old Colony Railroad Company for \$17,250 for tide water displaced by filling done in

South Bay was in the hands of the Attorney-General. This case has been decided by the Supreme Judicial Court adversely to the Commonwealth, on the ground that the work done under chapter 519 of the Acts of 1897 was in accordance with the expressed command of the Legislature and in the interest of public security and convenience, and that the statute did not contemplate that compensation for tide water displaced should be assessed in this particular instance. (See opinion of the court in *Bradford v. Old Colony Railroad Co.*, 181 Mass. Reports.)

MYSTIC RIVER.

On April 11, 1902, the Board approved plans submitted by the Board of Metropolitan Park Commissioners for a new bridge, authorized by chapter 491 of the Acts of 1901, across Mystic River near the site of the old Middlesex Avenue bridge.

These plans provide for a pile bridge with a retractile draw therein, and a passageway for vessels 50 feet wide. The license for this work requires that the material used for filling the approaches to the bridge in tide water, to the grade of 13 feet above mean low water, shall be dredged from Mystic River to such depths, having due regard to the straightening and widening of the present channel in this river between the Boston & Maine Railroad bridge, western division, and the new bridge, as the Board shall from time to time prescribe.

On April 25, 1902, the Board granted a license to the Boston & Maine Railroad to fill flats at the Dirty Marshes, so called, and to build a pile platform, on Mystic River in Somerville. This license authorized the work to be done between the Boston & Maine Railroad bridge, Western Division, and the easterly side line of location of the Middlesex Fells Parkway, the outer line of the pile platform being in continuation of the outer line of filling constituting the approach to the Middlesex Avenue bridge on the Somerville side of the river.

The licensee therein agrees to dredge an area in Mystic River between said railroad bridge and the easterly side line of the parkway, excepting that portion adjoining and 50 feet

outside of the line of the railroad bridge, to a depth not less than 4 feet below mean low water, all the dredging to be done within two years from the completion of the Middlesex Avenue bridge by the Metropolitan Park Commissioners; also to dredge in such localities and to such depths, having due regard to the straightening and widening of the present channel in said river between the railroad bridge and the Middlesex Avenue bridge, as the Board shall from time to time prescribe, so that the channel shall be not less than 100 feet wide and 9 feet deep at mean low water.

As the work covered by these two licenses was, in part, beyond the harbor line approved by the Secretary of War, June 20, 1890, the licensees were required to obtain his consent. On May 29, 1902, the United States harbor line covering this frontage was modified, thus enabling the licensees to do the desired work.

The river in this locality makes a wide bend with the main channel, curving well to the north of the middle, and at low tide a large area of unsightly flats is exposed. The gain by lowering these flats to a plane of 4 feet below mean low water is sanitary and utilitarian, as well as æsthetic.

MERRIMAC RIVER.

May 26, 1902, the Legislature adopted, in concurrence, the following order:—

Ordered, that the Board of Harbor and Land Commissioners investigate and report on the feasibility and advisability of opening the Merrimac River to navigation from Lowell to the sea. Said Board shall report, with such suggestions and recommendations as it may deem proper, to the next General Court, on or before the first Monday of February.

No appropriation was made for the investigation indicated in said order, therefore, the Board inferred that the General Court sought an examination and statement of the surveys already made by the United States Engineers, together with a report and opinion thereon without any original surveys and investigation by the chief engineer of the Board and his assistants.

Acting on that view, the Board has examined the reports of the United States Engineers who have surveyed the river from Haverhill to Lowell, and made reports thereon; and the chief engineer of the Board has made studies and examinations of the plans referred to by the United States Engineers; also, the Board has made a personal inspection of that part of the river, for the purpose of gathering general information on the subject.

Much work has been done by the United States at the mouth of the river and from Newburyport to Mitchell's Falls, 21½ miles above Newburyport and about 3 miles above Haverhill.

The depth of water over the bar at the mouth of the river has been increased by the construction of jetties which confine the current and force it to scour a channel through the bar.

Work is now in progress for widening and deepening the channel from Newburyport to Haverhill. About \$600,000 has been expended to the present time on those two improvements.

According to the last United States survey, in 1901, there was 12.6 feet in the channel over the bar, and at ordinary high tide there is 12 feet of water to Haverhill bridge and 10 feet to Mitchell's Falls, about 3 miles above Haverhill bridge, and a depth of 4.5 feet through Mitchell's Falls to the head of the upper falls. This depth over Mitchell's Falls is only maintained when the mill water at Lawrence is running.

An examination of the river at Mitchell's Falls was made by Prof. Henry Mitchell, of the United States Coast Survey, at the expense of the Pentucket Navigation Company, and his report and plan are in the report of the United States Coast Survey for 1867, and a copy of the report is contained in the annual report of the Chief of Engineers, U. S. A., for 1870, page 474. He reported that the river could be made navigable for barges drawing 4 feet of water, without the construction of locks, by excavating channels through the falls, and drawing barges through the channels by means of tow boats fitted with windlasses.

Maj. Gen. J. G. Foster, of the United States Engineers, made a similar report in 1870 on the same subject. (See annual report of the Chief of Engineers, U. S. A., for 1870, pages 471-473.)

In 1872 surveys and estimates were made for the improvement of navigation of the river between Haverhill and Lawrence, and a report made thereon by Brigadier-General Thom and his civil assistant, Mr. Gorham P. Low, Jr. This report can be found in the annual report of the Chief of Engineers, U. S. A., for 1872, pages 961, 963.

Later surveys, covering the river as far north as Manchester, N. H., were made under direction of General Thom by Mr. Sophus Haagensen, and are found in the annual report of the Chief of Engineers, U. S. A., for 1882, Vol. 1, pages 532, 534.

Blue prints of the plans accompanying the reports of the United States Engineers are now on file in the office of this Board.

There are other published reports of the United States Engineers on the surveys of the river between Haverhill and Lowell, but the reports above referred to contain the most careful surveys and best opinion obtainable on the subject.

Plans at the office of the Essex Company at Lawrence show surveys of the river from Mitchell's Falls to the dam in Lawrence, and plans on file in the office of the Locks and Canals Company at Lowell show the river from the Lawrence dam to the dam at Lowell, including respectively sets of plans of the locks and canals over the falls at Lawrence and Lowell.

In 1870 was begun the excavation of a channel through the lower portion of Mitchell's Falls; and at the end of 1874 channels 60 feet wide and 4 feet deep at ordinary water, with mill water running at Lawrence, had been excavated through both the upper and lower falls.

These channels were used principally for navigation by the Pentucket Navigation Company, which for a time maintained at the head of the channel a scow with winding engines operated by a flutter wheel driven by the current. This has not been in use for many years.

This work was the carrying out in part of the improvements planned by General Foster and General Thom, excepting that the bars of the river between Mitchell's Falls and Lawrence were not excavated.

At the lower falls the mean tide rises between 3 and 4 feet.

In the opinion of the Board, the best way to improve navigation between Haverhill and Lawrence would be the construction of a dam and lock at Mitchell's Lower Falls, the removal of boulders and the dredging in shoal spots of the river between the upper falls and the lower lock in the canal at Lawrence, and the raising of bridges or the substituting of draw bridges over the canal from the lower locks to the dam of the Essex Company at Lawrence.

No accurate surveys and measurements have been made by the chief engineer of the Board to ascertain the cost. It is assumed that a dam at Mitchell's Lower Falls, 4 feet high, with a lock of about the same size as the lower lock of the canal at Lawrence, would be sufficient. That would allow navigation of the river from Haverhill to the lower locks at Lawrence for barges drawing about 4 feet of water.

There are three locks in the lower canal at Lawrence, 100 feet long and 20 feet wide, but over the sill of the lower lock there is only about 2.5 feet of water at ordinary low water in the river. After passing the lower locks into the canal there are fourteen bridges over the canal, connecting the city proper with the mill yards. Five of the bridges are railroad, two are highway and seven owned by the Essex Company and several mills, for the mill operatives, teaming and general use. The distance from the lower locks to the dam is about 1 mile. Under these bridges there is very little head room, — in some instances not over 2 feet. It would be impracticable for barges or lighters to use the canal without raising the bridges or constructing draws therein.

The fall of the river at Lawrence from the dam to the lower locks is about 28 feet.

From the dam at Lawrence to Hunt's Falls below Lowell, at the junction of the Merrimac and Concord rivers, about 9 miles, navigation is practicable after dredging away the shoals and boulders near its upper end.

At Hunt's Falls there are two sections, the upper and lower falls. From the basin above the falls, near the first lock on the Lowell canal to the basin below, is about 5,700 feet, and in that length of river there was a fall of about 11 feet in 1881. This has been reduced by the Locks and Canal Company, so that now the upper basin above the falls is only 7 or 8 feet higher than the basin below the falls.

The fall in the river in the 9 miles from Lawrence dam to Hunt's Falls is only about 1 foot, and the channel is from 5 to 30 feet in depth, excepting one rocky shoal and some boulders which could easily be removed. At Hunt's Falls the current is very rapid, and the river bed is rocky and irregular and only 2 or 3 feet in depth for some distance.

At Hunt's Falls, in the opinion of the Board, it would be necessary to construct a dam and lock to aid navigation. It would not be practicable to cut away the falls sufficiently to allow barges to be drawn through a channel, because this would decrease the depth of water in the river above to less than the required navigable depth.

There are three locks in the canal between the Concord River and the pond above the Lowell dam. The length of the locks respectively is about 100 feet; the width of the lock gates is only 12 feet, and the locks would be available for craft drawing only 3 feet of water.

This canal from the lower locks at the Concord River junction to the dam above passes directly through the city. The fall from the dam to the lower lock is about 32 feet. Across this canal also are five highway bridges, three railroad bridges, and two mill bridges. Just above the lower locks is an old highway bridge, and the head room between the average surface of the water in the canal and the truss of the bridge is only 18 inches. This is a much-travelled street in the city, fully occupied on both sides with mills, warehouses or stores. It would be very expensive to raise the bridge, on which buildings have been erected on either side of the travelled way, or to make a draw therein.

General Thom in his report above cited (page 534) makes this estimate of the cost of a comparatively small part of the work necessary to open navigation from Lowell to the sea:

“The estimated cost of the several works projected as above for making the channel navigable from the head of Mitchell’s Falls (6 miles below Lawrence dam) up to the basin above Pawtucket dam in Lowell (*exclusive of new locks at Lawrence and Pawtucket dams*) is \$236,000.”

In the opinion of the Board, this report excludes the two largest items of cost.

The basin above Hunt’s Falls near the lower lock in the canal at Concord River junction might be developed with wharves and docks, but would be a poor location for delivery of freight. The canals at Lawrence and Lowell are now very little used for the passage of boats. Many years ago rafts of logs and spars or masts were carried through the locks. There was also some other freight carried through the canals. Careful records of both canals have been kept of the passage of barges, row boats, launches and canoes. The locks have been used for that purpose only a few times each for the last twenty-five years. No freight has passed through the canals for many years.

The locks of the Lawrence canal have been little used for the last twenty-five years. The record shows that only the following craft have passed the canal in the last three years : 1 steamer, 5 row boats, 14 canoes, 6 sloops, 4 boats, 2 scows, 8 dories and 1 gunning float, — 41 in all. Of these, 12 were carried around the locks by employees of the Essex Company to save the trouble of opening the locks and floating them through.

The street follows the left bank of the Lawrence canal most of the way from the lower locks to the dam. The right bank of the canal is covered with warehouses, mills and mill yards. There seems to be no suitable place on either side for wharves or docks.

The Board cannot give the approximate cost of the improvements indicated, for the reason suggested at the beginning of this report. In its opinion, however, the cost of the dam and lock at Mitchell’s Falls and at Hunt’s Falls, respectively, and the dredging of shoals and boulders at several places in the river between Haverhill and Lowell, would be the smallest of the items of cost. A very large

expense would be the raising of the bridges to make more head room, or providing the same with suitable draws; but larger than all would be the damages caused by the loss of power to the many mills on the banks of the two canals, and no approximate estimate of the cost can be given.

The dam at Mitchell's Falls would decrease the flow and fall of water at the lower locks and mill raceways in the canal at Lawrence. This would probably not cause so large damage and loss of power as the dam and lock at Hunt's Falls in Lowell. The building of a dam there would reduce the water power available for all the mills on the several canals in Lowell about 4 feet.

The cost of the work, including the building of two dams and locks, dredging shoals, removing boulders, damages to water power and cost of street and bridge changes in Lawrence and Lowell, could only be accurately determined after a long and expensive investigation by engineers and experts.

When completed, as above suggested, without substantially enlarging the locks (except at the lower lock in Lawrence), the river would be navigable to and through Lawrence by barges 20 feet wide, 100 feet long and drawing 4 feet of water; and to and through Lowell by barges 12 feet wide, 100 feet long and drawing 3 feet of water. Barges or craft of that size would not be safe for transporting freight even from Boston harbor. All freight for Lawrence or Lowell would require rehandling at Newburyport or Haverhill.

The amount of freight tonnage for the cities of Lawrence and Lowell should be considered in this connection. For the year ending June 30, 1902, all the freight carried into the two cities by the Boston & Maine Railroad was as follows:—

Carried into Lawrence:—

Tons of coal,	246,031
Tons of all other freight,	450,917

Carried into Lowell:—

Tons of coal,	295,697
Tons of all other freight,	520,145

Coal would be more likely to seek water transportation than other freight. The mills for the most part have spur tracks to their boiler rooms. The necessary rehandling of coal in the lower river and the carting from canal to boiler room would have to be added to the water-borne freights in offsetting the greater all-rail coal rates; and the difference in cost of transportation would probably be small. The outgoing freight from the two cities would largely be by rail.

The work of opening the Merrimac River from Lowell to the sea would be feasible and practicable from the engineering point of view; but, considering the large cost and the damages involved, and the relatively small savings on freight which must be rehandled on the lower river and transported in such small barges, the Board reports that, in its opinion, it is not advisable for the State to undertake the large expense of opening the river to navigation from Lowell to the sea.

The United States Engineers have for years made surveys and reports on this work, and the United States has expended large sums to improve the navigation of the Merrimac River. Apart from the large expense, it may be better to leave the work in sole charge of the United States.

CONNECTICUT RIVER.

In the spring of 1902 willow cuttings were placed on the bank of the river at Hadley which was protected by the riprapping done during 1901, extending along the bank a distance of 1,455 feet. Slight repairs were also made where the riprapping had been undermined by surface water, due to changes which had been made in the grade of the street, and alterations made in the drain to obviate any recurrence. A portion of the balance of the appropriation made by chapter 94 of the Resolves of 1901 was expended in the construction of a dike at a point just below the bridges crossing the river between Northampton and Holyoke, where the river had broken through the bank into a borrow pit which was dug when the grade of the adjacent street was raised, and was likely to do serious injury unless preventive measures were adopted, and in riprapping the river bank

in front of the dike to prevent its being undermined. The dike was constructed under a contract entered into with Seymour & Newell, the lowest bidder, on May 9, 1902. The riprapping of the bank was done by day labor, the stone being furnished under a contract entered into with Thomas H. Kiely, the lowest bidder, on Sept. 4, 1902. The cost of all this work is \$4,772.96, as appears in detail in the report of the engineer in charge.* It is not anticipated that it will be necessary for the State to do any further work for the protection of the river banks in the town of Hadley other than such small repairs as may be called for from time to time caused by damages from surface water.

The total amount expended at Hadley, up to Dec. 1, 1902, is \$56,704.58.

NEW BEDFORD AND FAIRHAVEN BRIDGE.

The Legislature, by chapter 439 of the Acts of 1900, constituted the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners a Joint Board, to prescribe the manner in which so much of the highway, bridge and approaches as remained to be completed should be constructed, and to approve all plans, specifications and requirements necessary to finish the undertaking. Under this authority votes approving the construction contracts as reported last year to the Legislature were passed, and the work has proceeded to completion, the Joint Board keeping informed of its progress, and holding such conferences as were necessary.

At a meeting of the Joint Board, held Sept. 8, 1902, a communication dated Sept. 4, 1902, was received from William F. Williams, chief engineer, stating that the New Bedford and Fairhaven bridge "is now open for public travel, and all travel has ceased over the temporary bridge." The Joint Board thereupon, in pursuance of the terms of a contract between Cole Brothers and the city of New Bedford, dated Sept. 11, 1900, requested the contractor to remove the temporary bridge, and it has been done.

* See Appendix B.

A hearing was given Nov. 24, 1902, by the Joint Board to contractors engaged in the work of completing the bridge, relative to several items of extra work, amounting in all to \$684.23; and the claims, being considered equitable, were approved.

The construction of that portion of the bridge under the supervision of the Joint Board is now complete, and the duties with which they were charged appear to be concluded.

Approximately, the cost of building that part of the bridge under the act amounts to \$290,000. This sum does not include land damages, of which \$23,000 has already been paid.

APPONAGANSETT HARBOR.

By chapter 509 of the Acts of 1902 the Board was authorized and directed to improve the harbor at Apponagansett in the town of Dartmouth by building a stone breakwater at its entrance, substantially in the location recommended in the annual report of the Board for 1901, and to expend not exceeding \$30,000 therefor. After an examination of the locality and conference with parties specially qualified to form a judgment and those interested in the improvement, it was decided to build a stone breakwater of granite quarry-grout, 5 feet wide on top at an elevation 6 feet above mean low water, and with the sides sloping at angles of 1 on $1\frac{1}{2}$.

The breakwater was planned to begin at a point about 250 feet from the high-water line, where there is a depth of about 4 feet at mean low water, in order to allow small boats to pass near the shore.

With the appropriation available it was estimated that a breakwater 700 feet long could be built of the dimensions above described, and on July 31 a contract was entered into with E. S. Belden & Sons, the lowest bidder, to build the same for the sum of \$1.07 per ton of stone placed in the work. Up to Dec. 1, 1902, 14,191 tons have been built into the breakwater, the contract providing that the whole shall be completed on or before July 1, 1903.

CATAUMET HARBOR.

By chapter 71 of the Resolves of 1902 the Board was directed to cause a survey and estimate to be made as to the cost, best method and advisability of improving Cataumet harbor, and authorized to expend not exceeding \$500 therefor. This harbor is an indentation in the easterly shore of Buzzards Bay, on the boundary line between the towns of Bourne and Falmouth, and lies conveniently between the railroad stations of Cataumet and North Falmouth. The harbor is open to the south-west, and the anchorage is well protected from northerly and easterly winds. The prevailing winds through the summer months and yachting season are from the south-west, to which the anchorage is exposed. There is a small area forming a channel leading to the wharf on the Megansett side of the harbor, which is partially protected by the shoal making out from the point on which the wharf is located. The deeper-draught yachts anchor on the easterly side of this channel, thereby obstructing and rendering it difficult for the steamer which plies along this shore of the bay through the summer to make a landing. Leading from this anchorage is a narrow channel having a depth of from 2 to 4 feet at mean low water for a distance of about half a mile, and continuing for another half mile with a depth of not less than 1 foot at mean low water. This channel leads into Squeteague Pond, where there is an anchorage of about $17\frac{1}{2}$ acres, with a depth of not less than 5 feet at mean low water. Many of the smaller boats are kept along this channel and in the pond, passing in and out at or about high tide.

Upon inquiry among parties interested in the harbor and having summer residences in this vicinity, it was learned that the owners of the larger yachts desire to have an anchorage dredged out near the steamboat landing, while the owners of some of the smaller boats and those residing on the shores of Squeteague Pond desire to have a channel excavated into the pond, so that it can be used for the anchorage of their boats, which may then get in and out at all stages of the tide.

In order to determine the practicability of any of these projects, a survey was made of the harbor from the outer entrance of the channel leading to the steamboat wharf up to and including Squeteague Pond. This was done during August and September, and the results plotted on a scale of 1/2000. Nearly $4\frac{3}{4}$ miles of shore line were surveyed, and 5,800 soundings and levels taken over an area of about 169 acres. On the plan were laid out the various projects for improvement.

Three such projects have been prepared, shown on the plan appended, one for dredging an area of about 14 acres easterly of and adjoining the channel leading to the steamboat landing, where an anchorage basin would be partially protected by the point on which the steamboat landing is located and the shoal extending from it. It would be desirable to dredge the westerly portion of this area to the depth of 9 feet at mean low water, to accommodate the larger boats, and the inner portion to 6 feet at mean low water. The following is an estimate of the cost of the work:—

9 foot area, 39,800 cubic yards, at 30 cents, . . .	\$11,940
6 foot area, 64,000 cubic yards, at 30 cents, . . .	19,200
Incidental and contingent expenses, 10 per cent., . .	3,114
Total,	<u>\$34,254</u>

This estimate is based on the use of the ordinary style of dipper or clam-shell dredge; but if a hydraulic dredge could be obtained for use on the work it could probably be done for a smaller price per cubic yard. In that case, however, the depth on the 6 foot area would have to be increased to enable the dredge to work properly, and this would add largely to the amount of material to be excavated, so that the final cost of excavating an anchorage basin of the same area would probably not be materially less than as stated above.

The other two projects are designed to give access to Squeteague Pond, in order that the deep-water area there may be used for an anchorage. One project is for a channel 6 feet deep at mean low water and 200 feet wide, cutting through the beach at the westerly corner of the pond. The

opening being into the outer portion of the main harbor, the entrance of the channel would have to be protected by two stone jetties similar to those built by the Commonwealth at Cottage City. The cost of this project is estimated to be as follows : —

Dredging the channel, 78,000 cubic yards, at 35 cents, . . .	\$27,300
Building stone jetties and riprapping slopes of channel through beach, 6,000 tons stone, at \$2.50,	15,000
Incidental and contingent expenses, 10 per cent., . . .	<u>4,230</u>
Total,	\$46,530

The third project provides a channel 3 feet deep at mean low water and 100 feet wide, leading from the inner portion of the harbor through the beach into Squeteague Pond. This would accommodate only the smaller class of boats and makes no provision for the larger ones. The cost of the dredging contemplated by this project would be comparatively large, as, owing to the depth of water, only small dredges and scows could be used. The cost of this project is estimated to be as follows : —

20,000 cubic yards, at 50 cents,	\$10,000
Building stone jetties and riprapping slopes of the channel through beach, 2,200 tons, at \$2.50,	5,500
Incidental and contingent expenses, 10 per cent., . . .	<u>1,550</u>
Total,	\$17,050

In making the above estimates no account has been taken of any land damages. If either of the projects for using Squeteague Pond should be adopted a considerable section of the neck of land lying between the pond and the harbor would be cut off from connection with the main land; and, although this is apparently not used for any purpose at the present time, it cannot be assumed that the owners would not want damages. If either of these plans should be adopted, a portion of the material excavated from the channel could be used in building a causeway to connect this portion of the neck with the main land.

The Board does not deem the advantages to the public to be commensurate with the cost of the improvement.

The amount expended by the Board from the appropriation \$356.33.

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NANTUCKET HARBOR.

In January, 1902, a petition was received from the selectmen of Nantucket and others, asking for the removal of certain rocks in Nantucket harbor claimed to be dangerous to navigation.

In June an inspection was made by the Board and the chief engineer, and it was decided to take out the boulders. In consideration that Congress had made an appropriation for the improvement of this harbor, and in expectation that the contractors for the government would be at work there during the year, with whom a contract might be made for removing these rocks for a far less sum than would be required in employing a contractor with proper equipment to go to Nantucket for that purpose alone, the matter has awaited opportunity of accomplishment without disproportionate expense to the Commonwealth.

SCORTON HARBOR.

In 1898, under the authority of chapter 442 of the Acts of that year, a new outlet for Scorton River was excavated through the beach at an expense of \$2,940. Shortly after the completion of the work the great storm in November of that year greatly enlarged the cut which had been made, and since that time the marshes and cranberry bogs lying along the river have been thoroughly drained and the harbor used to some extent by fishermen.

Physical changes soon took place, as was anticipated, and a shoal at once began to form on the westerly side, developing into a tongue or spit parallel with the shore, thus forcing the channel inside, which in turn cut out the bank on the easterly side at about the same rate of progress. The river mouth is constantly moving south-easterly, as the outside spit builds up by current and wave action, and the shoaling of the entrance causes the sea to run in combers, rendering entry unsafe and often impossible.

Pursuant to chapter 130 of the Resolves of 1902, requiring the Board to make an investigation as to the advisability and cost of completing improvements at this place, a survey was made in September at a cost of \$68.70. The low-water

entrance to the harbor has moved between 800 and 900 feet eastward, so that boats now entering the harbor have to sail nearly that distance in the trough of the sea. The people interested in this harbor and the fishermen who use it desire the erection of structures designed to so control and direct the currents and the drift of the sand that the entrance will remain permanently opposite the point where the cut was made through the beach.

The locality is exposed to the full force of the Atlantic, and any structures built there must be strong and solid to be able to resist the continuous pounding of the sea in heavy easterly gales.

A number of years ago, it is said, at the harbor of Sandwich, similarly situated and about 2 miles to the westward of this entrance, the beach was cut through and a single jetty of timber supported by stone built out at right angles to the shore in line with the easterly side of the cut. The current maintained a channel for several years alongside this jetty, until it was broken through by a vessel driving against it; the channel then shifted over to the easterly side of the jetty and maintained itself there for a time. Finally, the structure became so injured that the sand drifted over and around it, and, as a result, the entrance is now being forced to the eastward, as at Scorton harbor.

If any plan is to be adopted for further improving this harbor, it should provide for the construction of a stone jetty starting from the sand ridge on the easterly side of the present entrance and extending north-easterly at right angles to the general trend of the beach, to where there is a depth of about 3 feet at mean low water,—about 600 feet away from the high-water line on the beach to the eastward of the entrance. This should be 15 feet wide on top, with side slopes of 1 on $1\frac{1}{2}$, and built with heavy riprap stone, the centre composed of small chip stone supported and held in place by the large stone in the outer surface.

In addition, the banks of the channel through the ridge of the beach should be protected by stone riprap. At the present time the harbor runs practically dry shortly after half tide, and boats of limited draught can enter and leave it

only at or about high water. There is no basin in the harbor where boats can lie afloat at all stages of the tide. It is not anticipated that the construction of the jetty as described would increase the depth of water in the harbor, but only enable boats to enter at that stage of the tide when there is sufficient depth of water for them, without being obliged to sail for a considerable distance in the trough of the sea. The estimated cost of this jetty is as follows:—

20,500 tons of stone, at \$2,	\$41,000
4,500 tons riprap, at \$2.25,	10,125
Incidental and contingent expenses, 10 per cent., .	5,112
Total,	<u>\$56,237</u>

The total amount expended for the improvement of this harbor, up to Dec. 1, 1902, is \$3,017.17.

The benefits to this locality would not be commensurate with the cost of the improvement, and, in the opinion of the Board, the expenditure would be inadvisable.

WITCHMERE HARBOR.

No work has been done at Witchmere harbor during the present year. From an examination of the entrance early in the summer it appeared that the channel had deepened slightly, but there is not sufficient depth to enable large boats to enter the harbor. Some difficulty has been caused by the current scouring out the sand from the inner portion of the channel and depositing it in the deep water of the harbor proper, forming shoals.

The Board has received no complaints in regard to sea weed being lodged on the beach this season.

The total amount expended for the improvement of this harbor, up to Dec. 1, 1902, is \$4,912.21.

SCITUATE.

By chapter 434 of the Acts of 1900 the Board was authorized to expend a sum not exceeding \$15,000 for protecting the shores and harbor of the town of Scituate. A sea wall 998 feet long was built in 1900 along the crest of the narrow beach at the Sand Hills, between Scituate harbor and the

ocean. Considerable attention was also given to determining at what other point it was necessary to build structures to carry out the objects of the act. After conferring with the selectmen, it was decided that a wall should be built along the crest of the beach lying between Damon's Island and the Glades at North Scituate. As the estimates for the work exceeded the balance available in the appropriation, the town voted to make up any deficiency, and appropriated \$3,000 therefor at the March meeting in 1902. Proposals were then invited, and it was found that, owing to the favorable prices obtained, the work could be done within the appropriation made by the Commonwealth, and a contract was entered into on April 17, 1902, with Ward & Cummings, the lowest bidder, to build 1,450 feet of concrete sea wall along the crest of the beach, on the easterly line of the location of the highway over the beach. The work was completed July 30, 1902, at a cost, including superintendence and incidentals, of \$6,345.35, or at the rate of \$4.37+ a running foot.

Since the completion of the wall the town has reconstructed the highway in a substantial manner.

The total amount expended at Scituate since the passage of chapter 434 of the Acts of 1900, up to Dec. 1, 1902, is \$12,189.03.

WEST BAY, OSTERVILLE.

By chapter 491 of the Acts of 1902 the Board was authorized to expend a sum not exceeding \$7,500 for further improving, by dredging, the channel from Vineyard Sound to Osterville Bay in the town of Barnstable. After an examination, a contract was entered into with John H. Gerish on Aug. 8, 1902, to do the work for 32 cents a cubic yard, the same to be completed by May 31, 1903. Prior to signing the contract, releases were obtained from owners of land on the shores of the bay, permitting the dumping thereon of the material dredged, thereby diminishing the expense by avoiding the necessity of carrying that material into the sound.

LAKE ANTHONY.

By chapter 399 of the Acts of 1901 the Board was authorized to expend a sum not exceeding \$5,000 for dredging and other work to improve the harbor at Lake Anthony, in Cottage City. In that year the area on both sides of Joy's wharf on the southerly side of the harbor was dredged to the depth of 5 feet at mean low water, in order to enable the boats using the harbor to have free access to the wharf. At the same time ten permanent moorings, consisting of large stones, chains and casks, were placed around the harbor, in order to afford safety to yachts during heavy winds, the bottom being so soft that anchors will not hold. The cost of these moorings and the dredging was \$2,863.51. During the present year the balance of the appropriation has been expended in enlarging the anchorage area about 1.3 acres by dredging along the southerly and westerly sides of the harbor for a distance of about 1,100 feet. The material excavated has been placed along the shore opposite the dredged area, making a sharp bank, and enabling vessels to tell definitely the limits of the anchorage area. The sanitary condition of the harbor is also benefited by filling in objectionable flats. The cost of this work was \$2,123.10.

An examination of the channel at the entrance of the harbor disclosed that the sea in heavy weather had driven considerable quantities of sand through the spaces between the large stones of the jetties and shoaled slightly the entrance. In order to prevent this, the spaces have been filled with concrete at an expense of \$221.23, and the entrance dredged. No further trouble is anticipated from this cause. The total amount expended for the harbor and entrance to Lake Anthony, up to Dec. 1, 1902, is \$26,634.97.

MENAMSHA INLET.

The conditions at Menamsha Inlet remain substantially the same as reported last year. It was decided to close up the holes between the large stones in the western jetty, to prevent the sea from driving the sand through them into the channel. This was undertaken in the latter part of the

summer, the spaces filled with concrete, and a short wing wall built of the same material, to keep the waves from washing around the inner end of the jetty and cutting out the sand from back of it. As soon as the holes between the large stones of the jetty were filled the current at once cut away the sand in front of the jetty, increasing the depth of the water materially at this place. By cutting off the supply of sand, which was being driven in from the beach to the westward, the sea and current can more easily cut away and deepen the channel through the bar at the entrance.

No material change has taken place where the timber wing jetty was broken down, as reported last year, and the beach at this place has built up nearly as high as at the portions where it is still protected by the timber work; at the same time the average depth of the channel in the rear is as well maintained as it was before the timber work was injured. The total cost of the work done here was \$478.49.

As stated in the last report of the Board, in order to secure the best results from the construction of the jetties, it will be necessary to carry out the balance of the work, and excavate a channel from a point between the jetties in a direct line across the flats to the entrance to the pond, and also build two short jetties or training walls to direct the current into the excavated channel. This work from the jetties to the channel opposite the boat landing of Mr. Mosher could probably be done at an expense not exceeding \$5,000, provided a dredge suitable for doing the work could be secured somewhere in the vicinity. The total amount expended for the improvement of Menamsha Inlet, up to Dec. 1, 1902, is \$10,412.75.

BASS RIVER.

By chapter 113 of the Resolves of 1901 the Board was directed to improve the entrance to Bass River in the towns of Dennis and Yarmouth, in accordance with its report (House, No. 1430), made June 4, 1901, and an appropriation of \$22,000 was made for the purpose.

On Nov. 14, 1901, a contract was entered into with Augustus Bellevue & Co., the lowest bidder, and it was expected that work would commence early in the spring, but

subsequently they assigned to Bigelow F. Nay, the assignment was approved by the Board Jan. 16, 1902, and the work was carried out by Mr. Nay. It was commenced early in April and completed Oct. 16, 1902. Two timber jetties were built to confine and direct the current of the river, and prevent the sea from driving the sand off the beaches on either side of the river mouth into the channel. The artificial channel was dug 1,400 feet long and 50 feet wide, straight from a point in the natural channel where it turned sharply to the eastward, about opposite the beach on the westerly side of the entrance.

This was done in order to direct the current in such a way as to scour a channel by the shortest path to deep water, instead of following the devious course it previously pursued. The westerly jetty is 950 and the easterly 2,423 feet long. They are built of oak piles and spruce timber, but nevertheless will require to be strengthened with stone riprap before many years. In building the easterly jetty across the old channel difficulties were encountered, but were overcome by putting in additional piles and using a number of sand bags during construction. The total cost of the work, including superintendence and engineering, amounts to \$22,800.50.

The work was planned with a view to a gradual enlargement of the dredged channel in the mouth of the river by aid of the scouring ebb of the tides, — a process which will take time in its accomplishment, and will require watching meanwhile of the structures, in order to meet and avoid unforeseen difficulties.

Had the appropriation permitted, it would have been desirable to continue the dredging farther into the Sound, and thus enable the scour of the river to make a deep and permanent channel at an early day, with less liability to variation after leaving the mouth of the jetties. As it was, however, the cost of the work slightly exceeded the estimate, and the balance of \$800.50 was paid from the appropriation for the survey and improvement of harbors, made by chapter 107 of the Acts of 1902.

The total amount expended in improving the entrance to Bass River, up to Dec. 1, 1902, is \$23,106.86.

GREAT PONDS.

It having been brought to the attention of the Board that parties were occupying islands in some of the great ponds of the Commonwealth without satisfactory title thereto, the Board took the opinion of the Attorney-General, which was printed in the report of last year.

Subsequently thereto the Attorney-General was requested to make claim to an island in Chebacco Lake, believed to be occupied under claim of squatter right only, and the matter is now pending in his office.

HANGMAN'S ISLAND.

In December the Board extended the lease to the present lessees of Hangman's Island, in Boston harbor, for three years from Jan. 1, 1902. It is well to have fishermen continue to occupy this island, as they have been helpful from time to time as life savers.

PROVINCE LANDS.

By chapter 511 of the Acts of 1902 the sum of \$10,000 was appropriated for continuing the planting of the sand binders, in order to arrest the blowing sand. Of this appropriation one-third was to be expended in each of the three years succeeding the date of the act, June 26. Owing to lack of funds, nothing was done prior to July, when the road across the lands was repaired. During September, October and November about 20 acres were planted, as usual, with the marram or beach grass (*Ammophila arenaria*), interspersed with bayberry (*Myrica cerifera*) and other shrubs transplanted from the surrounding country. The trees and shrubs are healthy and fairly vigorous, — as much so as could be expected, in consideration of their very exposed location and the lack of fertile soil.

Few situations are more exposed to harsh weather than the Province Lands at the end of Cape Cod. It is therefore interesting to discover what plants will live and flourish under such conditions as there exist. In an effort to ascertain this information, about 20 varieties have been tried,

the varying degrees of success fully appearing in the report* of the superintendent. Of those best adapted to the conditions there prevailing, he enumerates the native pitch pine, Scotch pine, Austrian pine, common alder, black locust, bayberry and Scotch broom. Comparisons made from time to time among the sand barrens which have been redeemed in various parts of the world will be interesting and instructive.

At the head of the harbor of Provincetown, and close to the southerly end of the Province Lands, the dunes are low, and form a narrow ridge between House Point Island flats and the sea. The beach is weak for a distance of some 2,800 feet south of Abel Hill dike, and last winter several inroads were made in the north-westerly storms. During the summer the federal government has been strengthening this beach by building plank and timber bulkheads, filled with sand, also groins of light lattice work and low sand-catching fences. Under this treatment the beach is building up, and danger from breaches of the sea through the dunes is diminished. Since 1826 the government has spent \$176,918 in this work.

The total amount expended by the Commonwealth on the Province Lands, up to Dec. 1, 1902, is \$28,818.28.

MT. TOM AND MT. NONOTUCK STATE RESERVATION.

Pursuant to chapter 124 of the Resolves of 1902, authorizing the Board to make surveys, examinations and estimates, to determine the probable cost of acquiring an area of about 3,000 acres of land situated on or about Mt. Tom and Mt. Nonotuck in the county of Hampshire, suitable for a State reservation, and making an appropriation of \$2,000 therefor, the Board, in July, 1902, visited the locality and examined the general outlines of the area referred to in the resolve. Subsequently surveying parties were organized and sent into the region, to obtain the contours, elevations, character and description of the land, and generally such other information as might assist in determining the questions involved.

On July 25 the work of making the necessary surveys was commenced. All available information which could be found

* See Appendix C.

in the offices of the city engineer of Holyoke, the Holyoke Street Railway Company, the Holyoke Water Power Company and the registry of deeds at Northampton, as well as of local engineers, was collected, and tracings made of the various plans. These were sent to the office of the Board, and enlarged or reduced to make them conform to the scale adopted for the surveys. The information thus obtained was useful in locating the property lines, many of which are so marked on the ground as to have been otherwise unascertainable.

Triangulation stations were selected and signals erected on all the main summits included within the area to be surveyed, and such additional ones as were required to give control to the work of the topographic party. These stations were connected by triangulation with the stations established by the town boundary survey. Traverse lines were then run, following the various highways and wood roads around and through the territory, and from these lines the brooks, buildings and other structures were located, and elevations of the various portions of the territory determined.

As the field work progressed, notes were taken and plotted on a series of three plane table sheets, which were later carried into the field with the plane table for the purpose of locating other details which could not be readily reached from the traverse lines. The field work was completed October 25, and the map of the land, on a scale of $\frac{1}{5000}$, finished in the office. In addition to the location of the lots, brooks, buildings and other features, contour lines of elevations at intervals of 20 feet are indicated. After completing the field work a tracing plan was made, showing the outlines of the various properties, and this was used by the real estate experts to assist them in locating the lots. A plan showing all the details of the surveys is appended.

The survey covered an area of about $6\frac{1}{2}$ square miles, 19 triangulation stations having been established, 52.3 miles of traverse lines run, and the elevation of the ground at 4,200 points determined.

The Board, accompanied by its chief engineer and the

engineer in charge of the work, visited the locality and made a careful examination of the existing conditions, walking and driving over such portions of the upland and lowland as would give a good idea of all the territory to be covered and the relations of its several parts. Four qualified experts in land values in that neighborhood were carefully selected, and, with maps in hand, visited all the lots and severally recorded, independently, their estimates of value. The average of their valuations is the basis of the probable cost of acquiring the areas hereinafter referred to.

Between the base of Mt. Tom on the south, Mt. Nonotuck on the north, and the travelled roads at the foot of the mountains on the east and west, lies an area of about 4,000 acres. Of this the city of Holyoke owns 266.3 acres on the south-east slope of Mt. Tom, including Whiting Street reservoir, for the purpose of a partial water supply and the protection of the water-shed adjacent to the lake. Surrounding the city's holdings on the north and west is a wild and partly wooded area, with a picturesque hill and vale surface of about 920 acres, owned by the Holyoke Street Railway Company and the Mt. Tom Railroad Company. This is to-day an attractive park, open to the public, in which certain improvements have been made in sundry places for the purpose of inducing patronage to the railroad company. This tract includes the summit of Mt. Tom, to which the railroad has been carried. There will also be found a refectory, concert hall and a tower of observation, included under one roof. Inasmuch as all this tract is open to public enjoyment, under circumstances and conditions which point to an indefinite continuance of a policy which has created this development for private interest without encouragement from the Commonwealth, no sufficient reason occurs to recommend its acquisition by the Commonwealth or its deprivation from the company now conducting it without cost to the public, who are yet realizing all its opportunities for enjoyment.

The remainder of the tract surveyed contains about 2,892 acres, of which a large portion is peculiarly well adapted for a public reservation. Of these it is believed that the tract

of 1,474.7 acres shown on the annexed plan will provide an ample reservation within the intent of the legislative resolve. Four approaches, 300 feet wide, are shown entering from the highway at convenient points on easy grades to centres especially attractive to the visitor. These approaches are outlined from the main highways through farms at the foot of the ascent, and are sufficiently wide to admit of carriage and foot paths protected by shade trees, and bridle paths if desired. They lead into the most picturesque and beautiful portions of the reservation.

There are bold palisades of some considerable height and grandeur; there are steep slopes and deep valleys, with babbling brooks and cool springs; undulating uplands, with groves of chestnut, oak, hemlock and pine, as well as sprout and deep tangled wildwood, — in short, every variety of pasture, wood lot and clearing, inviting rest to the weary or affording scope for activity to the restless.

Estimated at their full fair value, on the basis of the averages of the four experts, these 1,474.7 acres ought not to cost the State more than \$35,000. If this tract shall be deemed insufficient, it can be increased by additions from the farms on the east bordering on the highway to the extent of some 500 acres. These were not included in the shaded area on the plan, as not being especially attractive for park purposes, and because of being relatively higher in value, owing to the buildings and the location and character of the clearings. A fair estimate of the value of these additional acres on the east side should be about \$42,000. The amount expended by the Board from the appropriation of \$2,000 will not exceed \$1,750.

TOWN BOUNDARY SURVEY.

The work of determining the location of the town boundaries has continued with the same organization as last year. Two field parties were at work throughout the season and one additional field party for about six weeks on the town boundary work, with this exception, that one of the field parties, together with the assistant engineer in charge of the work and one draughtsman, were detailed from six to eight

weeks to make the necessary surveys of Mt. Tom and Mt. Nonotuck, required by the provisions of chapter 124 of the Resolves of 1902.

The field parties during the year made surveys and examinations in 36 cities and towns, 16 of these being in Middlesex County, 16 in Norfolk County and 4 in Essex County. In addition to the local surveys at the various boundary monuments, 56 miles of roads and streams where they formed the town boundaries were surveyed. From the notes of these surveys plans will be plotted during the winter, and filed as required by the Statutes.

During the year 7 atlases, covering 20 cities and towns, have been published, and another atlas of the boundary lines of the city of Boston and town of Brookline is now in press. It is proposed to continue this work during the coming year, and, with the data collected during the past season, atlases covering 40 towns can be published. In addition to this work, the examination of the Statutes preparatory to further field work has been carried along, and the necessary information for the field parties for the coming year has been prepared.

Plans of portions of the boundary lines between the city of Marlborough and the town of Southborough, between the towns of Lynnfield and Saugus and between the towns of Carver and Wareham, as established by the Statutes of 1901, have been prepared and filed with the Secretary of State.

A plan for straightening that portion of the boundary line between the towns of Braintree and Holbrook, where it is impossible to determine the location of the original line, has been prepared and sent to the towns interested for their concurrence.

The scheme of publishing in a single atlas the information relating to the boundaries of a group of towns, instead of publishing in one atlas information only relating to a single town, has been continued. The full benefit of the reduction in cost caused by this change will not be obtained before next year, as in a number of cases the atlases published this year contain groups of a small number of towns which were surrounded by towns whose atlases had already been pub-

lished, making it impracticable to include in one atlas as large a number of towns as might otherwise have been consolidated. During the coming year the atlases will contain an average of at least twice as many towns as those published the past year.

STATE BOUNDARIES.

During the winter the second stone bound was set on the shores of Lake Monomonic, in accordance with the plans stated in the last report of the Board, thus completing the work on the New Hampshire line. A plan showing the location of the new bounds placed near the lake has been made, and a copy of it will be filed with the Secretary of State.

Early in the year a letter was sent to the Governor of Rhode Island, stating that the Board proposed to replace the monuments which had been disturbed in the boundary line between Massachusetts and Rhode Island, and inviting co-operation. A reply was received that the matter would be brought to the attention of the General Assembly. Nothing further, however, having been received, on November 8 a second letter was sent, stating that the Board proposed to set three new stone bounds: One at Ellery Street, between the towns of Wrentham in Massachusetts and Cumberland in Rhode Island, to replace a stone which is too small to properly mark the point and at the present time is so insecurely set as to be easily removed by anyone maliciously inclined. Second, a bound on the westerly line of Canal Street, between the towns of Blackstone in Massachusetts and North Smithfield in Rhode Island. A change is made here because the existing mark at this place, which is buried 4 inches below the surface of the ground, is located on the easterly side of the street, where a bound projecting above the surface would seriously interfere with the use of the adjoining property. Third, a new bound in the line between the towns of Douglas in Massachusetts and Burrillville in Rhode Island, at a point a short distance west of Hemlock Street. This bound is needed to replace a stone too small to properly mark the point, and which at the time of the examination was found to have been pulled from the hole in

which it was set and laid flat on the adjoining land. No answer having been received to this communication, three new bounds were ordered from the same parties who furnished all the bounds used by the Commonwealth to mark the State line. They have been set in the places above described. They are 12 inches square, about 8 feet long, and are lettered "Mass." on one side and "R. I." on the other, with the date 1902, and below, the initial letter of the adjacent town. The setting of these stones completes all the work necessary to put the marking of the Rhode Island line in good condition.

Early in the year a communication was received from the State engineer of New York, inviting co-operation in the perambulation of the boundary line between Massachusetts and New York. As we had perambulated this line a little more than two years previously, it did not seem to the Board that the benefit to be gained by such perambulation would warrant the necessary expense, and a reply to that effect was sent to the engineer of the State of New York, with a statement that, in case he found any of the bounds disturbed, we were prepared to co-operate with him in replacing them. Later in the season a letter was received, stating that the bounds on the line had been found in good condition. At one point the bound was tipped slightly out of the perpendicular, but this was righted, and the marking of the line is now in good condition.

The whole boundary of the Commonwealth is now well and frequently marked by permanent stone and iron bounds, excepting the portion between Massachusetts and Connecticut. The portion of this line west of the Connecticut River was originally laid out in 1803 and the easterly portion in 1826. Comparatively few points are actually marked, and these are not of a permanent character or such as would be set at the present day. An arrangement should be made to re-run and mark this line whenever the State of Connecticut is ready to co-operate.

In the report of the Commission on the Topographical Survey and Map of Massachusetts for 1898, the cost of re-locating and marking the Connecticut line was estimated to

be \$14,000, of which one-half should be paid by each State. This estimate was based on the cost of the work which had been done in relocating and marking the line between Massachusetts and New York.

SALE OF MAPS.

Under the provisions of chapter 57 of the Resolves of 1890 the Board has for sale copies of the various atlas sheets of the State map. The edition of a number of these sheets has been exhausted, while in most of them a large stock still remains. Those exhausted are the ones for which there is the greatest demand, and, as the office of the Board is the only place in the State where a large number of maps is kept, the Board has deemed it proper to purchase sheets from the United States Geological Survey at Washington, where the plates are owned, and where they can be procured at the rate of \$2 per 100 sheets, while they are sold by the State at the rate of 5 cents each.

Considerable changes have occurred in the topography in various parts of the State, and many of these have been mapped and placed on the engraved copper plates by the Geological Survey, so that the new sheets now printed show the present condition much more nearly than the original sheets.

During the year, under chapter 57 of the Resolves of 1890, 9 atlases, 2 folios and 3,183 additional sheets of the State topographical maps have been sold, for \$205.50. Under chapter 360 of the Acts of 1900, 2 town boundary atlases have been sold, for \$5. One hundred and seventy-one atlases have been sent to the officers of the various cities and towns, as provided by law. Under chapter 95 of the Resolves of 1891, 86 topographical atlases have been distributed, 83 being sent to free public libraries. The proceeds of the above sales have been paid into the treasury of the Commonwealth.

WRECKS.

Early in February the Boston, Revere Beach & Lynn Railroad Company notified the Board that an obstruction existed in the harbor opposite pier No. 6 of the Grand

Junction wharves at East Boston, directly in the course of the ferry boats of the company, and that the boats had struck it one or more times at low water. Upon examination it was found that a large spud, consisting of four sticks of timber bolted together and with a heavy cast-iron point on the lower end, which had belonged to one of the dredges in the harbor, had been broken off and was standing upright in the location described. This obstruction was removed at the expense of the owner of the spud.

While engaged on this work it was learned that a similar spud had been lost in the same vicinity by another dredge which had been engaged in dredging the main channel of the harbor under the direction of the United States Engineers. The attention of the officer in charge was called to the matter, and on May 12, 1902, notice was received from him that the spud had been found and removed from tide water.

SURVEYS.

The work done by the engineering department during the year has kept pace with that of previous years. In connection with the improvement of the Commonwealth flats at South Boston, surveys and plans were made for the filling of the area east of the flats already filled, which had previously been enclosed by a sea wall and bulkhead. Plans were also made for the construction of a pile wharf, which has been leased to the Boston Molasses Company, and surveys and plans made for the necessary dredging for docks and approaches to the wharf; also for the necessary drains and for paving the approaches to the lot leased. The necessary laying out and supervision of these various works has also taken a large part of the time of the assistant in charge of work on the flats. The supervision of the dumping of the material dredged from the anchorage basin at Bird Island, the yacht anchorage on the south side of South Boston, the deepening of the channel at the mouth of Charles River, and the dredging on the Commonwealth flats at South Boston, has necessitated the employment of an additional force of dumping inspectors.

In addition to the work above described and that of the

parties engaged on the town boundary survey, the time of one assistant for three months has been occupied in the measurement of the excavated material and the supervision of the work of dredging in South Bay, under contract with John C. Cobb. Another assistant was employed throughout the summer on the supervision of the construction of jetties at the mouth of Bass River and the dredging of a channel through the bar at the mouth of the river.

In December, 1901, surveys were made at Stony Beach, in Hull, and at the Glades Beach, in North Scituate, to determine to what extent the contour of the beaches had been changed by the heavy storms which had occurred about the first of the month.

In January, February, August and October surveys were made over the area dredged at the mouth of Charles River, both before and after the dredging was done. In all, 13,800 soundings were taken on this work.

In January and February surveys were made over the area dredged in the dock on the west side of the Commonwealth pier at South Boston.

In February, March, April and May a survey was made of the flats extending eastward from Jeffries Point, East Boston, to determine their exact elevation and dimensions, for use in the suit brought by the East Boston Company against the Commonwealth to determine the ownership of the flats. In this work 22,770 soundings were taken, and the position of 8 triangulation stations determined.

In February surveys were made to locate the obstruction which it was reported existed off Pier No. 6 of the Grand Junction wharves, East Boston.

In March borings were made in the location of the proposed harbor line at Haverhill, in the vicinity of Haverhill bridge, to determine the depth at which rock was found in this locality.

In March a survey was made to locate the highway on the Glades Beach at North Scituate.

In April a survey was made of Shirley Gut, to determine the extent of the changes which had taken place during the winter, and as a basis for estimating the quantity of material

necessary to be removed from the extremity of Point Shirley to restore the channel to the same condition as in 1901.

In June a survey was made of the dredged channel in West Bay at Osterville.

In June, July and August a survey was made of a portion of Dorchester Bay along the southerly shore of South Boston, preparatory to excavating an anchorage basin, as authorized by chapter 425 of the Acts of 1902. About $1\frac{9}{10}$ miles of shore line were surveyed and 10,000 soundings taken over an area of 689 acres.

In July a line of levels was run from the Navy Yard to Jeffries Point at East Boston, to determine the elevation of the tide gauge used in making the survey of the flats extending eastward from Jeffries Point.

In July, August, September and October a survey was made, under the provisions of chapter 124 of the Resolves of 1902, of Mt. Tom and Mt. Nonotuck, as a basis for determining what area would be best suited for a public reservation.

In August and September a survey was made of Cataumet harbor, under the provisions of chapter 71 of the Resolves of 1902.

In September a resurvey of Scorton harbor was made, under the provisions of chapter 130 of the Resolves of 1902. About 1 mile of shore line was surveyed and 2,138 soundings taken over an area of about 75 acres.

In October and November a survey was made over the area dredged in South Bay, to determine the extent to which the contract requirements had been executed.

In November a hydrographic survey of a portion of Mystic River between Chelsea and Malden bridges was made, and on November 12 a hydrographic survey of a portion of Malden River from its mouth to the wharf of the United States Steel Company.

INSPECTIONS MADE BY THE BOARD DURING THE YEAR.

1901.

- Dec. 31. Plant of New England Sanitary Product Company at the Calf Pasture, Old Harbor Point.

1902.

- Feb. 15. Mary's Pond at Rochester, relative to petition for license to draw water from this pond for flowing cranberry bogs.
- Feb. 20. Reserved Channel and portion of Commonwealth flats at South Boston, in company with legislative committee.
- Feb. 25-26. Herring River at West Harwich, and East and West bays at Osterville, in company with legislative committee.
- Mar. 18. Wharf of Standard Oil Company of New York on Chelsea Creek at East Boston, relative to proposed extension.
- Mar. 20. Boston harbor, in company with legislative committee.
- Mar. 25-26. Bass River at South Yarmouth, relative to work authorized by chapter 113 of the Acts of 1901 and chapter 174 of the Acts of 1902.
- Apr. 18-19. Work done on jetties at Bass River in South Yarmouth, under direction of the Board.
- May 2. Mary's Pond in Rochester, also Blackmore's Pond at South Wareham, relative to petitions for licenses to draw water from these ponds for flowing cranberry bogs.
- May 5-7. Province Lands at Provincetown, Scorton harbor at East Sandwich, jetties at Menamsha Inlet, site of proposed breakwater in Apponagansett harbor at South Dartmouth, — in company with legislative committee.
- May 6. Work done on jetties at Bass River in South Yarmouth.
- May 9. Work done on sea wall and jetties at Stony Beach in Hull, under direction of the Board.
- May 12-13. Work done on jetties at Bass River in South Yarmouth.
- May 15-17. Work done on sea wall at North Scituate; also work done on sea wall and jetties at Stony Beach in Hull.

1902.

- May 20. Commonwealth pier at South Boston, and other terminal points in Boston harbor, in company with the dock commissioners of New York and others.
- May 23. New Bedford and Fairhaven bridge.
- May 28-29. Work done on sea wall at North Scituate; also work done on sea wall and jetties at Stony Beach in Hull.
- June 2. Protective work in progress on the bank of the Connecticut River in Hadley, under direction of the Board.
- June 4. Work done by the Roxbury Central wharf in South Bay.
- June 6-7. Work done on jetties at Bass River in South Yarmouth.
- June 10. Southerly shore of South Boston, relative to dredging authorized by chapter 425 of the Acts of 1902.
- June 13-16. Nantucket harbor, relative to removal of certain rocks; Lake Anthony at Cottage City, relative to further improvement; sites of proposed wharf structures in Edgartown harbor.
- June 21. Protective work in progress on the bank of the Connecticut River in Hadley.
- June 24-25. Work done on sea wall at North Scituate and on sea wall and jetties at Stony Beach in Hull.
- July 1-2. Work done on sea wall at North Scituate, and on sea wall and jetties at Stony Beach in Hull; wharf of Samuel James, 2d, and others, in Hull.
- July 3. Wharf of F. L. Young, at foot of P Street, South Boston.
- July 5-6. West Bay at Osterville; also work done on jetties at Bass River in South Yarmouth.
- July 15. Work done on sea wall and jetties at Stony Beach in Hull.
- July 21-22. Work done on jetties at Bass River.
- July 23-25. Mt. Tom and Mt. Nonotuck, relative to survey authorized by chapter 124 of the Resolves of 1902.
- July 29. Site of proposed wharf of Trustees of White Head Association on Weir River in Hull.
- Aug. 1-2. Work done on jetties at Bass River.

1902.

- Aug. 4-6. Dredging in progress at Lake Anthony in Cottage City; Menamsha Inlet, relative to proposed work.
- Aug. 10-11. Apponagansett harbor, relative to work authorized by chapter 509 of the Acts of 1902.
- Aug. 22. Work done on jetties at Bass River.
- Aug. 25-26. Cataumet harbor, relative to survey provided for by chapter 71 of the Resolves of 1902.
- Aug. 28. Wharves of Messrs. Richards, Stone, Ginn and others, on Mystic River; also work done by the Boston & Maine Railroad on Millers River.
- Aug. 28 29. Protective work in progress on bank of Connecticut River in Hadley; work in progress on survey of Mt. Tom and Mt. Nonotuck.
- Sept. 5-6. Work done on jetties at Bass River.
- Sept. 13. Beaches in Marblehead, relative to a petition of the selectmen for authority to remove material.
- Sept. 18-19. Work done on jetties at Bass River.
- Sept. 20-22. Protective work in progress on bank of Connecticut River in Hadley; work in progress on survey of Mt. Tom and Mt. Nonotuck.
- Sept. 23. Nantasket Beach and other portions of the shore in Hull.
- Sept. 25-27. New Bedford and Fairhaven bridge; cause of complaint by the Union Street Railway Company; also work in progress at Apponagansett harbor, Lake Anthony and Bass River, and work done by the Commonwealth at Osterville.
- Oct. 6. Work done on jetties at Bass River.
- Oct. 7-8. Work in progress at Lake Anthony; also jetties at Menamsha Inlet.
- Oct. 23. Merrimac River from Haverhill to Lowell, in the matter of determining the advisability of opening the river to navigation from Lowell to the sea.
- Oct. 30. Work in progress on the Commonwealth flats.
- Nov. 5-6. Mt. Tom and Mt. Nonotuck, relative to State reservation.

LICENSES GRANTED DURING THE YEAR.

Nos.

2559. Petition of the New England Structural Company for license to build a pile wharf and drive piles for the support of a building on Island End River, in Everett. Granted Dec. 30, 1901.

Nos.

2560. Petition of the town of Plymouth for license to build and maintain three sewer outlets in Plymouth harbor. Granted Dec. 30, 1901.
2561. Petition of Adelaide L. Taft for license to build and maintain a pile pier and float in Buttermilk Bay, in Bourne. Granted Dec. 30, 1901.
2562. Petition of the Commercial Wharf Company for license to drive additional piles at the south pier of Commercial wharf in Boston harbor, in Boston. Granted Dec. 30, 1901.
2563. Petition of the Boston Yacht Club for license to extend its wharf, on piles, in Marblehead harbor, in Marblehead. Granted Dec. 30, 1901.
2564. Petition of Mary L. Goldthwait for license to extend her wharf, on piles, in Marblehead harbor, in Marblehead. Granted Dec. 30, 1901.
2565. Petition of Robert C. Hooper for license to build and maintain an iron and timber pier and a float, in Manchester harbor at Chubbs Point, in Manchester. Granted Jan. 1, 1902.
2566. Petition of Charles Maurais for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.
2567. Petition of Joseph O. Boucher for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.
2568. Petition of Edmond Leclere for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.
2569. Petition of Edmond Leveille for license to maintain a sea wall and filling in Salem harbor, in Salem. Granted Jan. 6, 1902.
2570. Petition of James C. Chalifour for license to maintain a sea wall and fill solid in Salem harbor, in Salem. Granted Jan. 6, 1902.
2571. Petition of Richard A. Everson for license to maintain flumes and draw water from Maquan Pond, in Hanson. Granted Jan. 6, 1902.
2572. Petition of Warren S. Bumpus for license to excavate a canal, build a flume and draw water from Clear Pond, in Plymouth. Granted Jan. 6, 1902.
2573. Petition of the Board of Park Commissioners of Boston for license to fill solid in Dorchester Bay. Granted Jan. 6, 1902.

Nos.

2574. Petition of the city of Boston for approval of plans for rebuilding Broadway bridge across Fort Point Channel, as authorized by chapter 452 of the Acts of 1900. Granted Jan. 6, 1902.
2575. Petition of the New England Sanitary Product Company for license to build a pile wharf and sea wall, to fill solid and dredge at Spectacle Island in Boston harbor. Granted Jan. 6, 1902.
2576. Petition of the Boston, Cape Cod & New York Canal Company for approval of plans for the construction of two stone jetties in Barnstable Bay, in Sandwich, under authority of chapter 448 of the Acts of 1899. Granted Jan. 28, 1902.
2577. Petition of Walter O. Luscombe for license to build a sea wall and fill solid, and to maintain a wharf already built, in Great Harbor at Woods Hole, in Falmouth. Granted Jan. 28, 1902.
2578. Petition of Joan E. Swift for license to build a sea wall and fill solid in Great Harbor at Woods Hole, in Falmouth. Granted Jan. 28, 1902.
2579. Petition of James E. Rothwell for license to build a sea wall and jetties, and to fill solid, in Cotuit harbor, in Barnstable. Granted Jan. 29, 1902.
2580. Petition of William F. Stanley and W. Wallace Benjamin for license to lay a pipe, build a pumping station and flume and draw water from Dunham Pond, in Carver. Granted Feb. 5, 1902.
2581. Petition of George H. Hood for license to build and maintain a pier in Manchester harbor, in Manchester. Granted Feb. 10, 1902.
2582. Petition of the New England Railroad Company for license to drive piles and build a structure for the support of an interlocking tower in South Bay, in Boston. Granted Feb. 17, 1902.
2583. Petition of Sarah B. Fay for license to maintain a wharf, walls, filling and marine railway in Little Harbor at Woods Hole, in Falmouth. Granted Feb. 17, 1902.
2584. Petition of the Boston Elevated Railway Company for license to build a sea wall and concrete piers, fill solid, widen its wharf on piles, and dredge, in Boston harbor at Lincoln wharf, in Boston. Granted Feb. 17, 1902.

Nos.

2585. Petition of Joseph W. Stickney for license to build a bulkhead and fill solid on Chelsea Creek, in Chelsea. Granted Feb. 17, 1902.
2586. Petition of Frank G. Burke for license to build and maintain a pile pier in Edgartown harbor. Granted Feb. 17, 1902.
2587. Petition of the Magee Furnace Company for license to fill solid on Chelsea Creek, in Chelsea. Granted Feb. 17, 1902.
2588. Petition of Stephen J. Connolly, Gregory P. Connolly and Thomas D. Connolly for license to rebuild their wharf, on piles, in Manchester harbor, in Manchester. Granted Feb. 17, 1902.
2589. Petition of Samuel Knight for license to widen his wharf, on piles, in Manchester harbor, in Manchester. Granted Feb. 17, 1902.
2590. Petition of the New England Telephone and Telegraph Company of Massachusetts for license to drive piles in Boston harbor at the South Ferry in East Boston for the support of a conduit and cable box. Granted Feb. 17, 1902.
2591. Petition of Clementine G. Ricketson for license to build and maintain a stone pier and float in Apponagansett harbor at Ricketson's Point, in Dartmouth. Granted Feb. 17, 1902.
2592. Petition of the city of Boston for license to repair the piers of Dover Street bridge on Fort Point Channel. Granted Feb. 24, 1902.
2593. Petition of Richard T. Green and John C. Harrington for license to build a pile wharf and marine railway and to dredge, on Chelsea Creek, in Chelsea. Granted Feb. 24, 1902.
2594. Petition of Walter Baker & Co., Limited, for license to build a foundation wall and a building in and over Neponset River, westerly of the foot bridge of said company in Milton. Granted Feb. 24, 1902.
2595. Petition of Leroy S. Johnson for license to fill solid in South Bay, at his wharf adjoining Albany Street in Boston. Granted Feb. 27, 1902.
2596. Petition of the Edison Electric Illuminating Company of Boston for license to build a bulkhead and fill solid near the Reserved Channel at South Boston. Granted March 7, 1902.

- Nos.
2597. Petition of the trustees of Salem Hospital for license to build a bulkhead and fill solid on South River, in Salem. Granted March 26, 1902.
2598. Petition of the Philadelphia & Reading Coal and Iron Company for license to drive piles at its wharf on Acushnet River, in New Bedford. Granted March 26, 1902.
2599. Petition of George B. Cudworth for license to rebuild his wharf on Assonet River, in Freetown. Granted March 26, 1902.
2600. Petition of the city of Boston for approval of plans for the construction of a bridge over Fort Point Channel, in the extension of Atlantic Avenue, as authorized and required by chapter 466 of the Acts of 1899. Granted March 26, 1902.
2601. Petition of Henry H. Fay for license to extend his wharf, on piles, in Great Harbor at Woods Hole, in Falmouth. Granted March 26, 1902.
2602. Petition of Daniel Crosby & Son for license to build and maintain a pile pier and launching ways in North Bay at Osterville, in Barnstable. Granted March 26, 1902.
2603. Petition of the city of Boston for license to drive piles at Malden bridge on Mystic River. Granted March 28, 1902.
2604. Petition of the Metropolitan Water and Sewerage Board for approval of plans for the construction of a pile wharf in Boston harbor on the southerly side of Deer Island, for the support of a water pipe, under authority of chapter 439 of the Acts of 1889. Granted March 28, 1902.
2605. Petition of Austin Ford & Son for license to build a sea wall and fill solid on Broad Canal, in Cambridge. Granted March 31, 1902.
2606. Petition of Mrs. Charles I. Gibbs for license to maintain a pier in Mattapoisett harbor, in Mattapoisett. Granted April 2, 1902.
2607. Petition of the Board of Public Works of New Bedford for license to extend Coffin Avenue sewer, build a retaining wall and fill solid on Acushnet River, in New Bedford. Granted April 4, 1902.
2608. Petition of the New Bedford Yacht Club for license to build and maintain a temporary pile pier and float in Padanaram harbor, in Dartmouth. Granted April 4, 1902.

Nos.

2609. Petition of W. Harry Brown for license to maintain a break-water in Buzzards Bay, and a boathouse and float in Great Harbor at Woods Hole, in Falmouth. Granted April 4, 1902.
2610. Petition of the Board of Metropolitan Park Commissioners for approval of plans for the construction of a pile bridge and approaches across Mystic River between Somerville and Medford, as authorized and directed by chapter 491 of the Acts of 1901. Granted April 11, 1902.
2611. Petition of Albert J. West for license to build and maintain a boat landing and excavate a channel, in Hull Bay at Park Island. Granted April 11, 1902.
2612. Petition of the Boston & Maine Railroad for license to fill flats and build a pile platform on Mystic River, in Somerville. Granted April 25, 1902.
2613. Petition of Joseph Stone for license to fill solid on Mystic River, in Boston. Granted April 25, 1902.
2614. Petition of the Fall River Iron Works Company for license to build a sea wall and fill solid on Taunton River, in Fall River. Granted April 25, 1902.
2615. Petition of the Chequaquett Club for license to build and maintain a pile pier in Centreville harbor, in Barnstable. Granted May 2, 1902.
2616. Petition of the city of Salem for approval of plans for laying a pipe in Salem harbor, for the purpose of sewage disposal authorized by chapter 353 of the Acts of 1901. Granted May 6, 1902.
2617. Petition of Benjamin F. Vose for license to lay a pipe, construct a flume and draw water from Marys Pond, in Rochester. Granted May 9, 1902.
2618. Petition of the State Wharf and Storage Company for license to build a pile wharf in Boston harbor, at East Boston. Granted May 9, 1902.
2619. Petition of H. E. Crandell for license to build and maintain a wharf and float in Lake Quinsigamond, in Worcester. Granted May 13, 1902.
2621. Petition of Eugene S. Morse for license to build a sea wall and fill solid in a dock on the south channel of Mystic River, in Boston. Granted May 13, 1902.
2622. Petition of Louis Curtis and Charles F. Adams, 2d, trustees, for license to build a sea wall and fill solid in a dock on the south channel of Mystic River, in Boston. Granted May 13, 1902.

- Nos.
2623. Petition of the town of Essex for approval of plans for reconstructing the bridge over Essex River in the village of Essex, as authorized by chapter 119 of the Acts of 1902. Granted May 15, 1902.
2624. Petition of Thomas Lahey for license to build a temporary pile wharf on Belle Isle Inlet, in Winthrop. Granted May 19, 1902.
2625. Petition of W. S. Lowe & Co. for license to build a pile wharf on Merrimac River, in Haverhill. Granted May 19, 1902.
2626. Petition of Joseph S. Bigelow for license to build and maintain a boat landing and float in Cohasset harbor, in Cohasset. Granted May 22, 1902.
2627. Petition of Elmore E. Locke, for license to build a bulkhead and pile wharf and fill solid on Malden River, in Malden. Granted May 22, 1902.
2628. Petition of the Whitman Mills for license to build a bulkhead and fill solid on Acushnet River, in New Bedford. Granted May 22, 1902.
2629. Petition of the Young Men's Christian Association for license to build and maintain a wharf and float in Lake Quinsigamond, in Worcester. Granted May 29, 1902.
2630. Petition of West's Beach Corporation for license to maintain a pier and floats in Salem harbor, in Beverly. Granted June 10, 1902.
2631. Petition of Joseph C. Nowell for license to build and maintain a wharf in Apponagansett harbor, in Dartmouth. Granted June 10, 1902.
2632. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for license to build and maintain a pile bridge across Monument River, in Bourne. Granted June 10, 1902.
2633. Petition of Oliver C. Lumbert for license to build and maintain a bulkhead and jetties in Cotuit harbor, in Barnstable. Granted June 10, 1902.
2634. Petition of Isaiah Spindell for license to maintain a sea wall and filling and to extend the same in Great Harbor at Woods Hole, in Falmouth. Granted June 26, 1902.
2635. Petition of Herbert F. Whiting for license to build and maintain a boat landing in Great South Pond, in Plymouth. Granted June 26, 1902.

Nos.

2636. Petition of William L. Henry for license to build and maintain a pile pier on Bass River, in Yarmouth. Granted June 26, 1902.
2637. Petition of Abraham Osborn for license to build and maintain a pile pier in Edgartown harbor. Granted June 26, 1902.
2638. Petition of the city of Fall River for license to extend a sewer in Riverview Street into Mount Hope Bay. Granted July 1, 1902.
2639. Petition of Alla M. Raymond for license to build and maintain a pile pier and float in Salem harbor, in Marblehead. Granted July 8, 1902.
2640. Petition of the Fall River Iron Works Company for license to build a sea wall and fill solid on Taunton River, in Fall River. Granted July 15, 1902.
2641. Petition of the town of Plymouth for license to build and maintain a sewer outlet in Plymouth harbor. Granted July 17, 1902.
2642. Petition of William F. Nye for license to maintain a pile wharf as now built and to extend the same in New Bedford harbor at Fish Island, in New Bedford. Granted July 17, 1902.
2643. Petition of Joseph H. Beale for license to extend a pier, on piles, and to locate and maintain a float, in Barnstable harbor, in Barnstable. Granted July 18, 1902.
2644. Petition of D. H. Craig for license to extend his wharf in Plymouth harbor, in Plymouth. Granted July 18, 1902.
2645. Petition of Alvarado A. Coburn for license to build and maintain a wharf and float in Lake Quinsigamond at Lincoln Park, in Worcester. Granted July 18, 1902.
2646. Petition of the Roxbury Central Wharf for license to construct wharves and docks and fill land and flats in South Bay, in Boston. Granted July 22, 1902.
2647. Petition of the South Bay Wharf and Terminal Company for license to fill land and flats in South Bay, in Boston. Granted July 22, 1902.
2648. Petition of the city of Fall River for approval of plans for the construction of a stone arch bridge and other work on Taunton River, in connection with the abolition of grade crossings in Fall River authorized by chapter 472 of the Acts of 1900. Granted Aug. 1, 1902.

- Nos.
 2649. Petition of Lester Leland for license to lay and maintain a pipe drain in Black Cove, in Manchester. Granted Aug. 4, 1902.
2650. Petition of William M. Butler for license to extend a wharf, on piles, in Edgartown harbor. Granted Aug. 5, 1902.
2651. Petition of Frances C. Lillie for license to build a pile wharf in Buzzards Bay at Woods Hole, in Falmouth. Granted Aug. 5, 1902.
2652. Petition of the city of Taunton for license to build a sea wall and rebuild its wharf on Taunton River. Granted Sept. 16, 1902.
2653. Petition of George Lowell Tracy and Augustus Tirrell for license to build and maintain a sea wall, pile pier and float on Weymouth Fore River, in Weymouth. Granted Sept. 16, 1902.
2654. Petition of William A. Keyes for license to excavate a channel, build a flume and draw water from Blackmore's Pond, in Wareham. Granted Sept. 16, 1902.
2655. Petition of Alvarado A. Coburn for license to maintain two wharves and two floats in Lake Whalom at Whalom Park, in Lunenburg. Granted Sept. 16, 1902.
2656. Petition of John D. Dickinson for license to build and maintain a boat house and pier, on piles, in Edgartown harbor. Granted Sept. 25, 1902.
2657. Petition of Clarence M. Nash and James L. Barnes for license to build and maintain a pier in Lake Chaubunagungamaug at Wawela Park, in Webster. Granted Sept. 25, 1902.
2658. Petition of Edmund D. Codman and Joseph B. Russell, trustees, for license to fill solid and drive piles at Lovejoy's wharf on Charles River, in Boston. Granted Sept. 29, 1902.
2659. Petition of Charles L. Eaton for license to build and maintain a sea wall in Massachusetts Bay at Clifton, in Marblehead. Granted Sept. 29, 1902.
2660. Petition of Edward C. Battis for license to build a bulkhead and fill solid in a dock on South River, in Salem. Granted Oct. 2, 1902.
2661. Petition of George H. Richards and Howard Stockton, trustees of the Toby Club, for license to build and maintain a stone and pile pier, float and marine railway in Pocasset harbor, in Bourne. Granted Oct. 2, 1902.

Nos.

2662. Petition of Lester N. Godfrey and others for license to build a sea wall and fill solid on Neponset River, in Milton. Granted Oct. 7, 1902.
2663. Petition of the New England Cotton Yarn Company for license to build a bulkhead, drive piles, fill solid and erect a building on Acushnet River, in New Bedford. Granted Oct. 10, 1902.
2664. Petition of the Boston & Maine Railroad for license to build a temporary drawbridge, on piles, across Millers River, in Boston and Cambridge. Granted Oct. 31, 1902.
2665. Petition of the city of Boston for license to repair and build an addition to its wharf on the easterly side of Long Island in Boston harbor. Granted Oct. 31, 1902.
2666. Petition of the New Bedford Gas and Edison Light Company for license to build a pile wharf on Acushnet River, in New Bedford. Granted Oct. 31, 1902.
2667. Petition of Francis C. Foster for license to maintain a wharf in Little Harbor at Woods Hole, in Falmouth. Granted Oct. 31, 1902.
2668. Petition of Moses Williams and others for license to build a dam across Cedar Pond Creek, in Bourne. Granted Nov. 10, 1902.
2669. Petition of the Butler Mill for license to lay and maintain pipes, build a crib and to dredge on Acushnet River, in New Bedford. Granted Nov. 10, 1902.
2670. Petition of Robert W. Emmons, 2d, and others for license to build a private road in Buzzards Bay at Toby Island, in Bourne. Granted Nov. 11, 1902.
2671. Petition of Robert W. Emmons, 2d, and others for license to build a boat landing in Buzzards Bay on the northerly side of Toby Island, in Bourne. Granted Nov. 11, 1902.
2672. Petition of the New England Sanitary Product Company for license to construct and maintain two dolphins in Boston harbor northerly of and near the wharf of said company at Spectacle Island. Granted Nov. 11, 1902.
2673. Petition of Samuel G. Irwin for license to rebuild a portion of his present wharf, on piles, and to widen the same, on piles, in Crystal Cove, in Winthrop. Granted Nov. 18, 1902.
2674. Petition of Samuel James, 2d, and others for license to extend their wharf in Hull Bay, in Hull. Granted Nov. 18, 1902.

70 HARBOR AND LAND COMMISSIONERS. [Jan.

Nos.

2675. Petition of Harrison Mitchell for license to build a wharf in Hull Bay adjoining Nantasket Avenue, in Hull. Granted Nov. 18, 1902.
2676. Petition of Elias P. Morton for license to build and maintain two wharves in Lake Chaubunagungamaug at Idler's Bluff, in Webster. Granted Nov. 18, 1902.
2677. Petition of William J. Sullivan for license to fill solid in South Bay, northerly of Massachusetts Avenue and westerly of the Midland Division of the New York, New Haven & Hartford Railroad, in Boston. Granted Nov. 18, 1902.
2678. Petition of Alexander C. Adams for license to build a pile and timber jetty in Cotuit Bay, in Barnstable. Granted Nov. 19, 1902.
2679. Petition of the city of Boston for license to dump snow and ice into tide waters. Granted Nov. 19, 1902.
2680. Petition of the Boston Elevated Railway Company for license to dump snow and ice into tide waters. Granted Nov. 19, 1902.
2681. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River from the yard of the Fitchburg Railroad Company at the foot of Haverhill Street, in Boston. Granted Nov. 19, 1902.
2682. Petition of Ada J. Gould for license to build and maintain a pile pier and float in Stage harbor, in Chatham. Granted Nov. 19, 1902.
2683. Petition of Allen F. Keith for license to build a wharf in Hull Bay adjoining Nantasket Avenue, in Hull. Granted Nov. 19, 1902.
2684. Petition of Sophia M. Luce for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.
2685. Petition of Harvey W. Everest for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.
2686. Petition of Margarethe E. Dreyer for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.
2687. Petition of Maurice H. Richardson for license to build a sea wall and fill solid in Sippican harbor, in Marion. Granted Nov. 21, 1902.

PETITIONS DENIED.

On April 24, 1901, a hearing was given on the petition of Nelson H. Seelye to legalize a structure purporting to have been built under a license granted Dec. 26, 1889, which, however, had not been recorded. It appeared that the structure was not built in accordance with the plans accompanying the license. The petition was opposed by adjoining owners, on the ground that it failed to conform to the requirements of the license and tended to impair their right of ingress and egress to their wharves. After several hearings and postponements for the convenience of the parties interested, on March 7, 1902, the Board gave the petitioners leave to withdraw.

On September 15 the Board declined to grant a permit to the selectmen of Marblehead to remove material from the southerly side of the causeway leading from Marblehead to Marblehead Neck, on the ground that the Fifty-seventh Congress at its first session authorized a survey and estimate of cost of a breakwater with a view to protecting said causeway from injury by the sea; consequently the Board could not approve any action which would tend to weaken the existing protection.

On Sept. 29, 1902, after a hearing at which remonstrants appeared in person and by counsel, the Board declined to grant a license to the city of Cambridge to build a bridge across Lechmere Canal on the plans as filed. The grounds of objection were that the tide waters over which the city had laid out a highway and planned to construct a bridge were within a public cove, not in a location above a lawful bridge in which no draw actually exists; and consequently the proposal of the city was in violation of the provisions of chapter 96, section 17, of the Revised Laws; and, further, it was objected that the city had failed to show any authority in law to justify the act of laying out a highway that encroached upon tide waters. Without questioning the right of the city to determine whether public necessity and convenience demanded the building of the proposed highway, the Board adjudged the objections of the remonstrants to be

well founded, and that ampler powers must be obtained by the city from the Legislature before the Board could take further action.

MISCELLANEOUS PERMITS GRANTED DURING THE YEAR.

JOSEPH L. BOARDMAN, to remove gravel from Salter's Beach, in Plymouth. Granted Jan. 28, 1902.

EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON, to erect a temporary building on Batchelders wharf, so called, on Fort Point Channel, in Boston. Granted Feb. 19, 1902.

TRUSTEES OF THE MAIN STREET LAND TRUST, to dredge material from Charles River on the Cambridge side of the channel near West Boston bridge. Granted Feb. 26, 1902.

JEREMIAH O'RIORDEN, to dredge a channel leading from the main channel in Weymouth Back River, and to dump the dredged material near the shore line of said river. Granted April 1, 1902.

PARK COMMISSIONERS OF MARBLEHEAD, to take stone for paving purposes from Hines' Beach and Ballast Beach, in Marblehead. Granted April 11, 1902.

ROWE BROTHERS COMPANY, to dredge material from Merrimac River. Granted May 5, 1902.

C. M. COLE, to dump material dredged from Hog Island harbor at West Falmouth, in Buzzards Bay. Granted May 16, 1902.

J. K. GANNETT, Jr., to remove gravel from North Scituate Beach, in Scituate. Granted May 26, 1902.

LOUIS T. CUSHING, to remove gravel from Collier's Beach, in Scituate. Granted June 24, 1902.

MARBLEHEAD CEMETERY COMMISSIONERS, to take stone for paving purposes from Ballast Beach, in Marblehead. Granted Sept. 18, 1902.

P. J. MULLIN & Co., and **J. C. MURPHY**, to construct three dolphins in Boston harbor near the Reserved Channel at South Boston. Granted Sept. 25, 1902.

NEW ENGLAND DREDGING COMPANY, to dredge material at Shirley Gut, in Boston harbor. Granted Sept. 25, 1902.

NEW ENGLAND DREDGING COMPANY, to use for storage purposes a portion of the Commonwealth flats at South Boston on the northerly side of the Reserved Channel. Granted Sept. 25, 1902.

JEREMIAH O'RIORDEN, to dredge material at Shirley Gut, in Boston harbor. Granted Sept. 25, 1902.

AMERICAN AGRICULTURAL CHEMICAL COMPANY, to dredge in Weymouth Back River and to dump the material in Lower Neck Cove, in Weymouth. Granted Oct. 3, 1902.

METROPOLITAN PARK COMMISSIONERS, to remove sand above high-water mark and between high and low water marks within the limits of the Nantasket Beach reservation. Granted Oct. 7, 1902.

CHARLES M. COLE, to dump material dredged in New Bedford harbor, at North Ledge in said harbor. Granted Nov. 19, 1902.

NANTASKET BEACH STEAMBOAT COMPANY, to remove accumulations of sand in the berths and around Pemberton pier, in Hull. Granted Nov. 19, 1902.

WORK OF THE UNITED STATES IN RIVERS AND HARBORS OF THE COMMONWEALTH.

The Board is indebted to Lieut.-Col. W. S. Stanton and Capt. Harry Taylor, Corps of Engineers, U. S. A., who are in charge of river and harbor improvements in eastern Massachusetts, and Maj. Geo. W. Goethals, Corps of Engineers, U. S. A., who is in charge of similar work in southern Massachusetts, for the following statements, which show the work accomplished in the rivers and harbors of this Commonwealth during the fiscal year ending June 30, 1902:—

STATEMENT OF LIEUT.-COL. W. S. STANTON, CORPS OF ENGINEERS, U. S. A.

BOSTON, MASS., NOV. 24, 1902.

Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, State House, Boston, Mass.

SIRS:—In accordance with your request of Nov. 17, 1902, I have the honor to furnish the following summary of work done by the United States during the fiscal year that closed June 30, 1902, in the rivers and harbors in my district in Massachusetts:—

The works of improvement under my charge on June 30, 1902, were:—

- | | |
|--------------------|--------------------------|
| 1. Lynn harbor, | 9. Cohasset harbor, |
| 2. Boston harbor, | 10. Scituate harbor, |
| 3. Chelsea Creek, | 11. Duxbury harbor, |
| 4. Mystic River, | 12. Plymouth harbor, |
| 5. Malden River, | 13. Provincetown harbor, |
| 6. Charles River, | 14. Chatham harbor, |
| 7. Weymouth River, | 15. Removal of wrecks. |
| 8. Town River, | |

Boston Harbor.

The entire repointing of the sea walls on Great Brewster Island and at Point Allerton, 4,042 feet in length, was completed. On Deer Island the sea wall at the middle head, a large part of which was demolished by the storms of 1898, was rebuilt, and the rebuilding of the wall at the north head was commenced.

In the main ship channel, at the upper middle, 388,884.5 cubic yards were dredged, mostly of clay, substantially completing the dredging to deepen the main ship channel (upper and lower) to 27 feet at mean low water and widen it to 1,000 feet, with the exception of some scattering shoals, which remain to be removed to obtain that depth in fulfillment of the requirements of the contract.

In the upper main ship channel a contract for the excavation of 3,446 cubic yards of rock was completed, and 99 small points of ledge were also removed, obtaining a channel through the ledges at the upper middle 27 feet deep and 500 feet wide.

In the Broad Sound Channel, under the project adopted by the act of March 3, 1899, to obtain a channel 30 feet deep at mean low water and 1,200 feet wide, 380,844 cubic yards of hard pan, clay, gravel, sand and boulders were dredged, obtaining a channel 1,000 feet in width and 30 feet in depth, excepting some shoal places on Devil's Back at the ocean end of the channel.

Chelsea Creek.

Thirteen thousand, two hundred and fifty-five cubic yards of mud were dredged, extending the channel 75 feet wide and 18 feet deep at mean high water to a point opposite the works of the Revere Rubber Company, and widening the channel 14 feet deep at mean high water, thence to Proctor's wharf, to 50 to 150 feet.

Scituate Harbor.

Two thousand, eight hundred and eighty-seven cubic yards of gravel and beach shingle were dredged, completing the removal of a shoal that had encroached upon the dredged channel near the wharves.

Plymouth Harbor.

On Long Beach 6,526.5 linear feet of riprap dike were built, containing 13,728 tons of stone, completing the building of the dike, 10,468 feet long, authorized by the act of March 3, 1899.

Provincetown Harbor.

On the beach and sand dunes southerly from Abel Hill Dike 314 linear feet of dike of timber and sand, 737 linear feet of plank bulkhead, 2,100 linear feet of groins and 9,486 linear feet of low sand-catching fences were built. The bulkheads prevented an inroad by the sea into the harbor which was threatened by the storms of November to March.

Chatham Harbor.

On the three bars at the entrance to this harbor from Chatham Roads 16,599 cubic yards of sand were dredged, making channels 200 feet wide through the outer bar, 150 feet wide through the middle bar, and 100 feet wide through the inner bar, — all 6 feet deep at mean low water.

Removal of Wrecks.

Parts of the hulls of the schooners "Ira Laffrinier" and "Mondego" were removed from Nauset harbor.

Because funds were not available, no work was done in Lynn harbor, Mystic River, Malden River, Charles River, Weymouth River, Town River, Cohasset harbor and Duxbury harbor, Mass.

Very respectfully,

W. S. STANTON,

Lieutenant-Colonel, Corps of Engineers.

STATEMENT OF CAPT. HARRY TAYLOR, CORPS OF ENGINEERS,
U. S. A.

BOSTON, MASS., NOV. 19, 1902.

Board of Harbor and Land Commissioners, State House, Boston, Mass.

GENTLEMEN:—In accordance with request contained in your letter of the 17th instant, I have the honor to furnish the following summary of the work done by the United States during the fiscal year ending June 30, 1902, in the rivers and harbors of Massachusetts under the charge of this office:—

Newburyport Harbor.

During the past fiscal year no operations were in progress other than the removal of "North Rock" and the resetting of the beacon on the end of the north jetty. This beacon, which was displaced some time ago by severe storms, was reset during June, 1902, and about 100 tons of heavy stone placed around it for its protection.

The sum of \$30,000 was appropriated by the act of June 13,

1902, for continuing this improvement. These funds will be applied toward the extension of the south jetty and to such repairs as may be necessary to both jetties.

Merrimac River.

The present approved project for the improvement of this river provides for a channel 150 wide and 7 feet deep at mean low water (ordinary low-water stage of the river) from Newburyport to Haverhill. The first work under this project was begun in 1901, and at the close of the fiscal year ending June 30, 1901, a total of 4,792 cubic yards of material had been removed. During the past fiscal year dredging was continued, a total of 64,856 cubic yards of material being taken out during the year, exclusive of 2,572 cubic yards of boulders removed. The work thus far done has completed the 150 foot channel to the full depth and width for a distance of about $1\frac{1}{2}$ miles from Haverhill down river.

The river and harbor act of June 13, 1902, appropriated \$40,000 for the continuation of this work, and directed an examination to be made of the river, with a view to obtaining a depth of 9 feet to Haverhill.

Harbor of Refuge, at Sandy Bay, Cape Ann, Mass.

During the fiscal year operations have been continued on the construction of the substructure of the breakwater, a total of 113,-202 tons of rubblestone having been placed in it during the year. A small part of this stone was placed in the southern arm, to raise low places where the substructure had been beaten down by the sea. The substructure of the southern arm of the breakwater is completed to mean low water, except for a distance of about 70 feet. Most of the work during the year was applied to the extension of the western arm, which was raised to elevation —12 for a distance of 400 feet from the angle at Abner's Ledge, and a core of the superstructure was built on this 400 foot section up to mean high water, 12 feet wide on top.

The river and harbor act of June 13, 1902, appropriated \$200,000 for continuing this improvement.

Rockport Harbor.

No work has been done on this harbor since 1847, when two breakwaters were built at the mouth of the harbor. Since that time these breakwaters have so far deteriorated by the action of the sea that they fail to effect the purpose for which they were built.

The river and harbor act of June 13, 1902, appropriated \$22,000 for rebuilding the breakwaters to a height of about 10 feet above high water with heavy rubblestone, and for the removal of the principal rocks in the harbor.

Gloucester Harbor.

No operations were in progress on this work during the fiscal year.

The river and harbor act of June 13, 1902, placed this improvement under the continuous contract system, appropriating \$75,000 for the work, and authorizing the Secretary of War to enter into such contracts as may be necessary to complete the project, to be paid for out of such appropriations as may from time to time be made by law, not to exceed in the aggregate \$227,083. This act also provided that the existing project may be so modified that the breakwater now under construction shall terminate at Cat Ledge; and that the remainder of the funds authorized to be expended by said act and not required for construction of the breakwater shall be applied toward the removal of "Round Rock," in Gloucester harbor.

Beverly Harbor.

This is new work, so far as improvement of the harbor by the United States is concerned. From the survey made in 1900 it was found that the harbor has an available channel of 18 feet at mean low water to the wharves of the town, but that the channel was somewhat contracted at certain points.

By the river and harbor act of June 13, 1902, Congress adopted a project for widening the present channel in its narrow places so as to give a clear width of 200 feet, and appropriated \$10,000 for doing the work.

No work was in progress during the fiscal year on any of the other Massachusetts works in my charge.

Very respectfully,

HARRY TAYLOR,
Captain, Corps of Engineers.

Statement of Maj. Geo. W. Goethals, Corps of Engineers, showing work done by the United States on the rivers and harbors in Massachusetts under the Newport, R. I., engineer office, during the fiscal year ending June 30, 1902:—

Hyannis Harbor.

No operations have been in progress during the past fiscal year. This project contemplates the dredging of an area of 36 acres protected by the breakwater to a depth of 15.5 feet. Of this area, about 26.6 acres have been dredged and two cuts 25 feet wide each and 13 feet deep have been dredged in to the wharf of the New York, New Haven & Hartford Railroad Company.

The river and harbor act of June 13, 1902, appropriated \$35,000 for continuing the improvements at Hyannis and Nantucket, Mass.; of this amount, \$20,000 has been allotted to Hyannis and \$15,000 to Nantucket. The work of dredging will be continued during the coming year.

Nantucket Harbor.

No operations have been in progress during the past fiscal year. The project for this harbor contemplates the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal currents to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging when necessary to obtain a depth of from 12 to 15 feet at low water in this channel. The west jetty has been built for a distance of 4,955 feet and the east jetty 4,840 feet from the initial points on shore. Portions of both jetties are still to be built up to their projected cross-sections. Of the \$15,000 allotted from the appropriation of June 13, 1902, \$7,000 will be used in dredging a 10 foot channel across the bar at the entrance to the channel, and the balance in making a survey and building up a gap in the east jetty near the shore end.

Vineyard Haven.

No operations have been in progress during the past fiscal year. In the river and harbor act of June 13, 1902, Congress authorized a general investigation of the subject of harbors of refuge for Vineyard and Nantucket sounds, with a view to determining the best location or locations for such harbors.

Woods Hole Channel.

No operations have been in progress during the past fiscal year. The existing jetty provides for deepening the channel through the strait to 13 feet at mean low water, and widening the same to 300 feet. There is now a fairly good channel of one-half the projected width, 150 feet, and 13 feet depth through the strait.

The appropriation of \$20,000 for this work, made by the act of June 13, 1902, will be expended in completing the southern half of the channel and widening it to the northward.

New Bedford Harbor.

No operations have been in progress during the past fiscal year. The projected channels 18 feet deep extending from the deep water of Buzzards Bay to New Bedford and through the new drawbridge have been completed; and the appropriation of June 13, 1902, of \$37,700 is for the completion of the anchorage area and some work in cleaning out the draw channel, which will complete all present approved projects.

Taunton River.

No operations have been in progress during the past fiscal year. The existing project contemplates dredging a channel so that it shall have a width of 100 feet and depth of 12 feet from the mouth of the river up to Berkley bridge; thence 12 feet depth and 80 feet width up to Briggs Shoal; thence 11 feet depth with the same width to the ship yard; thence 11 feet depth and 60 feet width up to Weir bridge, the depths all being referred to mean high water. This project is essentially completed, but there are a few points at which the channel requires widening. The appropriation of \$5,000 made by the act of June 13, 1902, will be expended in widening the channel at points below Berkley bridge.

Fall River Harbor and Mount Hope Bay.

No operations have been in progress during the last fiscal year. Under the provisions of the river and harbor act of June 13, 1902, the project for the improvement of this harbor was enlarged so as to include dredging a channel 300 feet wide and 25 feet deep at mean low water across the flats in Mount Hope Bay to the deep water north-west of Common Fence Light, the northern point of the island of Rhode Island. Work under this project will be prosecuted during the coming year.

Removal of Wrecks.

During the fiscal year the following wrecks were removed so as no longer to form obstructions to navigation: the schooner "Electa Bailey," from Harding's Beach, Chatham, Mass.; and the "John Cullana" and "Alfred W. Fiske," from the Stone Horse Shoal off Monomoy Point, Cape Cod.

TAUNTON RIVER AND BOSTON HARBOR CANAL.

In accordance with the provisions of chapter 82 of the Resolves of 1902, the Board forwarded to each member of the General Court and to each Representative and Senator from Massachusetts in the Congress of the United States, a copy of the report of the Board relating to its survey of the proposed canal from Taunton River to Weymouth Fore River.

HARBOR COMPENSATION FUND.

There was paid into the treasury of the Commonwealth during the year, under sections 14 and 16 of chapter 19, Public Statutes, chapter 146, Acts of 1897, and chapter 96 of the Revised Laws, for tide water displaced by work done under licenses granted by the Board, and for rights and privileges granted in tide waters and great ponds, the sum of \$32,036.42, which was credited to the harbor compensation fund for Boston harbor. The amount in this fund on Nov. 30, 1902, was \$389,901.08; the balance of income from this fund in the treasury on the same date was \$2,349.51; the total income for the year was \$17,341.62.

COMMONWEALTH'S FLATS IMPROVEMENT FUND.

The balance in the Commonwealth's flats improvement fund on the first day of December, 1901, was \$605,296.25. To this has been added during the year \$14,644.44 from the income of the fund and \$1,019,531.96 from sales and rents of lands and other sources, making a total of \$1,639,472.65. Of this sum there has been expended during the year \$123,109.70, leaving a balance on Nov. 30, 1902, of \$1,516,362.95.

The foregoing report is respectfully submitted.

WOODWARD EMERY,
CHARLES C. DOTEN,
GEORGE E. SMITH,

Commissioners.

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APPENDIX.



APPENDIX.

[A.]

[See page 4 of this report, *ante.*]

CONTRACTS.

The contracts entered into during the year are as follows: —

1902.	
March 25.	With Lawler Brothers, for building sea wall and jetties at Stony Beach, in Hull, for the sum of \$4.90 for each lineal foot of completed sea wall 8 feet high, \$3.50 for each lineal foot of completed sea wall 6 feet high, and \$2.50 for each lineal foot of completed spur jetty, — amounting to \$7,854 92
April 14.	With the New England Dredging Company, for dredging in Boston harbor, near Fiske's wharf, for the sum of 29½ cents for each cubic yard of material, measured in scows, — amounting to about 29,000 00
April 17.	With Ward & Cummings, for building a concrete sea wall at North Scituate beach, for the sum of \$4.09 per lineal foot, — amounting to 6,130 50
May 9.	With Seymour & Newell, for building a dike on the Connecticut River, at Hadley, — amounting to 1,460 00
June 26.	With the New England Dredging Company and the Eastern Dredging Company, for dredging section 1 of the anchorage basin in Boston harbor, for the sum of 16⅔ cents for each cubic yard of material, measured in scows, dredged and deposited at sea; 19⅔ cents for each cubic yard of material, measured in scows, dredged and deposited on the Commonwealth flats, at South Boston; and 18⅔ cents for each cubic yard of material, measured in the fill, rehandled and graded on the Commonwealth flats, at South Boston, — amounting to about 202,000 00

1902.

June	26.	With Geo. H. Breymann & Brothers, for dredging section 2 of the anchorage basin in Boston harbor, for the sum of 15 cents for each cubic yard of material, measured in scows,— amounting to about	\$97,740 00
June	26.	With Geo. H. Breymann & Brothers, for dredging section 3 of the anchorage basin in Boston harbor, for the sum of 15½ cents for each cubic yard of material, measured in scows,— amounting to about	100,298 50
June	26.	With Geo. H. Breymann & Brothers, for dredging section 4 of the anchorage basin in Boston harbor, for the sum of 16 cents for each cubic yard of material, measured in scows,— amounting to about	104,688 00
July	3.	With the J. S. Packard Dredging Company, for dredging at wharf of the Boston Molasses Company on the Commonwealth flats, at South Boston, for the sum of 14½ cents for each cubic yard of material, measured in scows,— amounting to	10,845 04
July	9.	With John C. Cobb, for dredging a channel in South Bay, Boston harbor, for the sum of 23 cents for each cubic yard of material, measured in scows,— amounting to about	32,200 00
July	10.	With George Hayes & Co., for building a pile wharf on the Commonwealth flats, at South Boston,— amounting to	11,500 00
July	31.	With Eugene S. Belden & Sons, for building a stone breakwater in Apponagansett harbor, for the sum of \$1.07 for each ton of stone placed in the work,— amounting to about	30,000 00
August	8.	With John H. Gerrish, for dredging in West Bay, Osterville, for the sum of 32 cents for each cubic yard of material, measured in scows,— amounting to about	6,720 00
Sept.	4.	With Thomas H. Kiely, for furnishing riprap stone on the bank of the Connecticut River, at Hadley, for the sum of \$1.67 for each cubic yard of stone delivered,— amounting to	1,547 84
Sept.	4.	With Jones & Meehan, for paving street and building drains on the Commonwealth flats, at South Boston,— amounting to about	5,724 00
Sept.	8.	With John H. Gerrish, for dredging a portion of Lake Anthony, at Cottage City, for the sum of \$70 per day,— amounting to	2,080 00
Oct.	27.	With the New England Dredging Company and the Eastern Dredging Company, modification of contract of June 26, 1902.	

1902.

Oct.	29.	With the New England Dredging Company and the Eastern Dredging Company, for dredging in Dorchester Bay, for the sum of 21 cents for each cubic yard of material, measured in scows,— amounting to	\$11,760 00
		Total, about	\$661,438 80

[B.]

[See page 34 of this report, *ante*.]

REPORT OF ENGINEER IN CHARGE OF CONNECTICUT RIVER WORK.

To the Honorable Board of Harbor and Land Commissioners of Massachusetts, WOODWARD EMERY, Esq., Chairman.

GENTLEMEN: — Since my report of Nov. 9, 1901, relating to the protective work done that year on the easterly bank of the Connecticut River in the town of Hadley, under the provisions of chapter 94 of the Resolves of 1901, the following matters have been attended to and work done: —

Agawam Trespass.

In January last I was notified that parties, abutters on the Connecticut River in Agawam, without authority from your Board, were cutting the willows on the protective works put in there several years ago. The matter was referred to your Board, and following your instructions I laid the matter before District Attorney John F. Noxon of Pittsfield. Following his advice and with your approval, I personally notified all parties having lands abutting on the river and against the State protective works in Agawam to refrain from further trespassing or interfering with the State's work without consent of your Board. Since notifying them I have not learned of any further interference with the work.

The expenses incurred in this matter were \$27.96.

Setting Willows.

Willows were set last spring in the work done on the river bank in Hadley in 1901, and they have made a fair growth the past summer. The willows for this were mostly cut on the Agawam work, the supply furnished on the Hadley banks by former settings having been nearly exhausted in covering the work done in 1900.

The total expense of this work, including some slight repairs on a surface drain connected with the work of 1901, was \$385.36.

Hadley Dike.

The dike below the highway bridge, between Northampton and Hadley, suggested in my report of 1901, has been built the past summer, substantially as arranged with your Mr. Hodgdon, and on land known as the Townsend lot, secured by the town of Hadley for this purpose without expense to the State. This dike is of earth, and extends from the highway leading from Northampton to Hadley to a point near the river bank, below the break made by the spring freshets of last year, a distance of $1,093\frac{1}{2}$ feet. The crest of the dike is 8 feet wide, with side slopes of $2\frac{1}{2}$ to 1. The material for the dike was thoroughly rolled every 6 inches in thickness as it was put in place. After completion the slopes and crest were seeded with rye and several varieties of grass seed, which have made a good growth during the summer and fall.

The contract for building the dike was awarded May 9, 1902, by your Board to Messrs. Seymour & Newell of Springfield, for \$1,460, and they completed the work in a satisfactory manner and within the time limit mentioned in the specification.

The total cost of the work, including preliminary surveys, advertising, superintending, seed, etc., was \$1,731.54.

Riprap Work.

The river bank, against the dike, extending from the break in the bank, below the highway bridge above referred to, for a distance of 500 feet down stream, has been protected with mat work and riprap in the same manner as other work of this kind in Hadley in past years, and fully described in former reports.

This work does not extend below the low-water line, like that done in former years, the gradual slope in the bed of the river from low-water mark outward seeming to render this part of the work unnecessary at this place.

This protective work has been carried around the sharp point in the line of the river bank, caused by the break above referred to, and for some distance into the excavation made in the meadow for filling on the State highway several years ago.

The contract for furnishing the stone for this work was awarded by your Board to Thomas H. Kiely of Northampton, for \$1.67 per cubic yard of 4,500 pounds each. Mr. Kiely has carried out the provisions of his contract in a satisfactory manner, with the exception of a slight delay at one time in the delivery of stone, caused by heavy rains and bad condition of roads.

The number of yards delivered was 926.85; at \$1.67 per yard, is \$1,547.84.

Local help was employed, as in previous years, in laying the mats and riprap.

The total cost of this part of the work, including surveys, material (aside from stone), labor and superintending, was \$1,108.22; which, with the cost of stone delivered, makes the total cost of the protective work on the river bank for this season, exclusive of the dike and setting willows, \$2,656.06.

The area covered by the above work is 5,122 square yards, costing 51.85 cents per yard. There is yet some stone, already delivered, to be placed at the foot of the slope on the riprap, and this work will be attended to as soon as the river falls sufficiently to allow it to be done.

Respectfully submitted,

E. C. DAVIS.

NORTHAMPTON, MASS., Nov. 28, 1902.

[C.]

[See page 47 of this report, *ante*.]REPORT OF THE SUPERINTENDENT, PROVINCE
LANDS.

PROVINCETOWN, MASS., NOV. 20, 1902.

To the Board of Harbor and Land Commissioners.

GENTLEMEN:—As superintendent of the Province Lands, I respectfully submit my annual report of operations on the lands for the year ending with November, 1902.

The work has been carried on practically upon the same lines as in the several years past, consisting of care of the roadways, the transplanting of maram or beach grass (*Ammophila Arenaria*), bayberry (*Myrica cerifera*) and other shrubs.

Work was not begun until about the first of July, too late in the season for spring planting of shrubs, seed or grass; so our first attention was given to necessary repairs on the road leading across the lands, and which has been constantly used since its completion in the spring of 1901.

The work of transplanting beach grass and bayberry began about the middle of September, and continued, as weather permitted, until the middle of November, commencing on the second range of sand dunes, where suspended in the fall of 1901, and extending easterly along the slope of the range, a distance of about 2,000 feet, and covering a surface of about 20 acres.

We have made a more extensive use of the bayberry this season than heretofore, as the good results obtained seemed to warrant. Although we make slower progress in covering the surface than by the use of grass alone, it gives more permanent results, especially along the top of the slopes.

The work upon the lands shows gradual improvement, and the trees and shrubs, some of which are naturally of slow growth, are healthy and vigorous.

The roadway across the lands with terminus near the Race Point life-saving station, completed in June, 1901, is in good condition.

It has been a great convenience to townspeople, and is highly appreciated by the many summer visitors.

Since the beginning of the work of reclaiming the Province Lands, in the spring of 1894, which work was largely experimental, several kinds of trees, shrubs and plants have been tried, with varied results. The following may be mentioned, and value of each estimated:—

Willows of Various Kinds. — None have proved of value, a small proportion living, but making no perceptible growth.

Silver Poplars (Populus alba). — Not of sufficient value to warrant use.

Tamarix (Gallica). — Of no value; not adapted to the soil.

Scotch Broom (Genista scoparia). — Has given fairly good results, but is liable to winter-kill, and does not propagate from its own seed, owing to the dryness of the surface of the ground. The only way it can be of use is by transplanting young plants which have been started in better soil.

Common Alder (Alnus communis). — Makes good growth; stands climate well; only used by transplanting, not being able to get good results from seed.

European White Birch (Betula alba). — Will live, but too slow growth.

Hornbeam (Carpinus betulus). — Of no value.

Cockspur Thorn (Crataegus Crus-Galli). — Of no value.

Common Privet (Ligustrum vulgare). — Of no value.

Silver Maple (Acer dasycarpum). — Not of sufficient value to warrant its use.

Black Locust (Robinia pseudacacia). — It seems of considerable value; makes good growth; to be obtained from plants; not able to get results from seed.

Juniper (Juniperus communis). — Of no value; does not thrive.

Tree of Paradise (Alanthus glandulosa). — Easily raised from seed, but not adapted to soil; of no value.

Bayberry (Myrica cerifera). — Easily transplanted; spreads over the surface, and valuable for the work; unable to raise it from seed.

Native Pitch Pine (Pinus rigida). — Valuable and reliable; bears transplanting well, and does well from seed.

Austrian Pine (Pinus Austriaca). — Easily raised from seed, and bears transplanting; is doing well.

Scotch Pine (Pinus sylvestris). — Of good value; easily transplanted, and does well from seed.

White Pine (*Pinus strobus*). — Does not seem to be adapted to soil or climate; makes very slow growth.

Seaside Pine (*Pinus maritima*). — Starts easily from seed, but will not bear transplanting; makes quick growth for first two or three years, then liable to die out; not to be depended upon.

Of the above-mentioned trees and shrubs, the following we consider of much value for the work, and think can be depended upon: native pitch pine, Scotch pine, Austrian pine, common alder, black locust, bayberry and Scotch broom.

Respectfully submitted,

JAMES A. SMALL,
Superintendent of the Province Lands.

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COMMISSIONERS' REPORT.

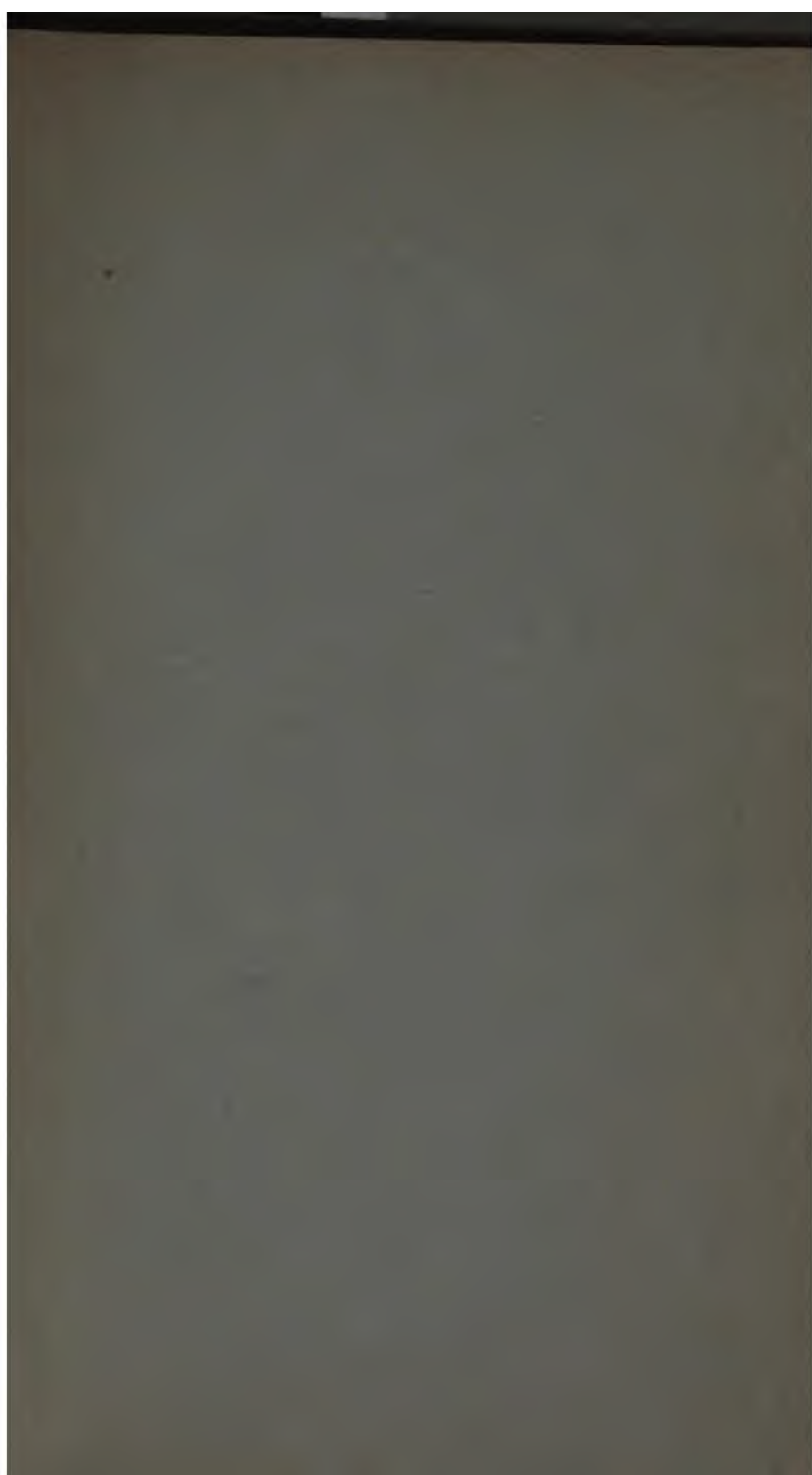
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